PROJECT MANUAL

NOVEMBER 14, 2024

VLK | ARCHITECTS

CCISD Priority Repairs – FAPE GOFE ROBE

CLEAR CREEK ISD

LEAGUE CITY, TEXAS

VLK Project No.

24-046.00

OWNER:

CLEAR CREEK INDEPENDENT SCHOOL DISTRICT

2425 East Main Street
League City, Texas 77573

OWNER

Clear Creek
Independent School District
2425 East Main Street
League City, Texas 77573

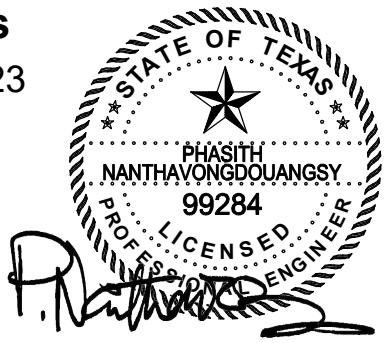
ARCHITECT

VLK Architects, Inc.
Michelle Gallup
20445 State Hwy 249, Suite 350
Houston, Texas 77070
Main Phone: 281.671.2300
www.vlkarchitects.com

11/14/2024

CIVIL ENGINEER

Adico Consulting Engineers
Firm Registration Number: F-16423
Phasith Nanthavong, P.E.
2114 El Dorado Blvd. Ste 400,
Friendswood, Texas 77546
Main Phone: 832.895.1093
www.adico-llc.com



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MEP ENGINEER

DBR Engineering Consultants, Inc.
Firm Registration Number: F-2234
William Meister, P.E.
9900 Richmond Avenue, 300 S. Bldg
Houston, Texas 77042
Main Phone: 713.914.0888
www.dbrinc.com

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NOVEMBER 14, 2024

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DOCUMENT 00 01 10

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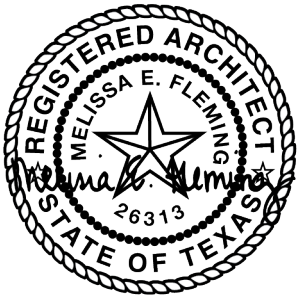

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DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

CONTRACTING REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

DIVISION 02 - EXISTING CONDITIONS

DIVISION 03 - CONCRETE

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DIVISION 04 - MASONRY

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DIVISION 05 – METALS and DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

NONE IN THIS PROJECT

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DIVISION 08 - OPENINGS

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DIVISION 09 - FINISHES

Section 09 21 16 - Gypsum Board Assemblies
09 30 00 - Tiling
09 51 00 - Acoustical Ceilings
09 64 29.13 - Refinishing of Wood Strip Flooring
09 65 00 - Resilient Flooring
09 65 44 - Linoleum Tile Flooring
09 67 23 - Resinous Flooring
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09 72 16 - Vinyl-coated Fabric Wall Covering
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10 22 39 - Folding Panel Partitions
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Section 11 61 00 - Stage Curtains
11 66 00 - Athletic Equipment

DIVISION 12 – FURNISHINGS through DIVISION 14 - CONVEYING EQUIPMENT

NONE IN THIS PROJECT

DIVISIONS 15 through 20 - Not used.

DIVISION 21 - FIRE SUPPRESSION

NONE IN THIS PROJECT

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DIVISION 22 - PLUMBING

Section 22 02 00 - Basic Materials and Methods for Plumbing
22 02 01 - Coordination Drawings
22 03 00 - Plumbing Demolition for Remodeling
22 05 13 - Common Motor Requirements for Plumbing Equipment
22 05 16 - Expansion Fittings and Loops for Plumbing Piping
22 05 53 - Identification for Plumbing Piping and Equipment
22 07 16 - Plumbing Equipment Insulation
22 07 19 - Plumbing Piping Insulation
22 08 00 - Commissioning of Plumbing Systems
22 10 00 - Plumbing Piping
22 11 19 - Plumbing Specialties
22 30 00 - Plumbing Equipment

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

Section 23 02 00 - Basic Materials and Methods for HVAC
23 03 00 - Mechanical Demolition for Remodeling
23 05 13 - Common Motor Requirements for HVAC Equipment
23 05 16 - Expansion Fittings and Loops for HVAC Piping
23 05 26 - Variable Frequency Motor Speed Control for HVAC Equipment
23 05 29 - Hangers and Supports for Piping and Equipment - HVAC
23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
23 05 53 - Identification for HVAC Piping and Equipment
23 05 93 - Testing, Adjusting, And Balancing
23 07 13 - Duct Insulation
23 07 16 - HVAC Equipment Insulation
23 07 19 - HVAC Piping Insulation
23 08 00 - Commissioning of HVAC Systems
23 09 63 - Energy Management and Control System (EMCS)
23 21 13 - Above Ground Hydronic Piping
23 25 13 - Water Treatment for Closed Loop Hydronic Systems
23 31 13 - Metal Ductwork
23 33 00 - Ductwork Accessories
23 34 00 - HVAC Fans
23 36 23 - Dual Duct Air Terminal Units
23 41 00 - Air Filters
23 73 13 - Modular Indoor Central Station Air Handling Units (Falcon Pass)

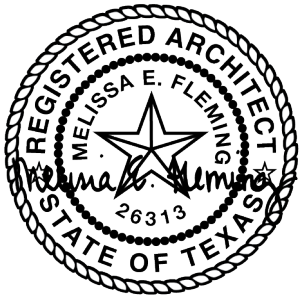
DIVISIONS 24 and 25 - Not used.

DIVISION 26 - ELECTRICAL

Section 26 02 00 - Basic Materials and Methods for Electrical
26 02 01 - Coordination Drawings
26 03 13 - Electrical Demolition for Remodeling
26 05 19 - Wire, Cable and Related Materials
26 05 26 - Grounding
26 05 33 - Raceways
26 08 00 - Commissioning of Electrical Systems
26 28 16 - Safety and Disconnect Switches
26 29 26 - Miscellaneous Electrical Controls and Wiring
26 32 13.09 - Natural Gas Engine-Driven Standby Generating System (60KW) (Robinson)
26 36 13 - Manual Transfer Switch and Docking Station (Robinson)
26 36 23 - Automatic Transfer Switches with Bypass Isolation (Robinson)
26 43 13.13 - Surge Protective Devices (SPD) - Standard Interrupting (Robinson)
26 51 19 - Lighting Fixtures - Light Emitting Diode (LED) (Goforth Robinson)

DIVISION 27 - COMMUNICATIONS

NONE IN THIS PROJECT



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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

NONE IN THIS PROJECT

DIVISIONS 29 and 30 - Not used.

DIVISION 31 - EARTHWORK

Section 31 00 00 - Site Earthwork
31 06 20.15 - Cement Stabilized Sand
31 06.20.17 - Utility Backfill Materials
31 11 00 - Site Clearing and Grubbing
31 22 00 - Site Grading

DIVISION 32 - EXTERIOR IMPROVEMENTS

Section 32 13 13 - Concrete Paving
32 13 13.10 - Concrete Paving Curing
32 13 13.25 - Concrete Sidewalks
32 13 73 - Concrete Paving Joint Sealants
32 91 13.13 - Topsoil Placement and Grading
32 92 00 - Turf and Grasses

DIVISION 33 - UTILITIES

Section 33 05 13 - Manholes and Structures
33 05 16.13 - Precast Concrete Utility Structures
33 05 16.16 - Concrete for Utility Construction
33 06 40.10 - HDPE Solid and Profile Wall Pipe
33 41 00 - Storm Utility Drainage Piping
33 49 13 - Storm Drainage Manholes, Frames and Covers

DIVISION 34 - TRANSPORTATION

NONE IN THIS PROJECT

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

NONE IN THIS PROJECT

DIVISIONS 36 through 39 - Not used.

DIVISION 40 - PROCESS INTERCONNECTIONS through DIVISION 46 - WATER AND WASTEWATER EQUIPMENT

NONE IN THIS PROJECT

DIVISION 47 - Not used.

DIVISION 48 - ELECTRICAL POWER GENERATION

NONE IN THIS PROJECT

DIVISION 49 - Not used.

DOCUMENT AA

REQUEST FOR COMPETITIVE SEALED PROPOSALS

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

OWNER:	**Clear Creek Independent School District** Central Support Facility 2425 E. Main Street League City, TX 77573 Representative: Mr. Alex Aragon
PROJECT:	**Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson Clear Creek ISD**
LOCATIONS:	**Falcon Pass ES; 2465 Falcon Pass; Houston, Texas 77062** **Goforth ES; 2610 Webster St; League City, Texas 77573** **Robinson ES; 451 Kirby Rd; Seabrook, Texas 77586.**
BUDGET:	**$ 7,023,823.00**
PRE-PROPOSAL CONFERENCE	Thursday, November 21, 2024, at 10:00 am, local time CSF Conference Room 2145 W. NASA Boulevard Webster, TX 77598
PROPOSAL DATE AND TIME:	**Base Proposals: Thursday, December 12, 2024, at 2:00pm, local time** **Alternate Proposals: Thursday, December 12, 2024, at 3:00pm, local time.**
LOCATION OF PROPOSAL OPENING:	**Central Support Facility Conference Room** 2145 W. NASA Blvd. Webster, TX 77598
ARCHITECT:	**VLK Architects, Inc.** 20445 TX-249, Suite 350 Houston, Texas 77070 281-671-2300

Qualified Offerors (General Contractors) may obtain two (2) sets of plans and specifications at place identified below upon deposit of $100.00 per set with check made payable to VLK Architects, Inc. The deposit will be refunded when the plans and specifications are returned promptly in good condition.

Proposal Documents may be obtained from the following address:

VLK Architects, Inc.
20445 TX-249, Suite 350
Houston, Texas 77070
281-671-2300

Office Hours are 8:00am - 5:00pm

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

Dodge Data & Analytics www.construction.com	Reed Construction Data (RCD) www.reedplans.com

FULL REFUND: Deposits will be returned provided all Contract Documents and addenda are returned to the Architect complete with all sheets bound in their original order within ten (10) days of proposal.

FORFEIT OF DEPOSIT: When the Documents are not returned under the conditions specified, none of the deposit will be returned. However, the Documents shall remain the property of the Owner and must be returned.

All proposals must be in submitted online in the Clear Creek ISD eBid System no later than the time specified above. Please visit https://ccisd.ionwave.net/Login.aspx

The Owner reserves the right to reject any and all proposals and to waive any formalities or irregularities in the Competitive Sealed Proposal process. No proposal shall be withdrawn within 60 days after the proposal opening without the specific consent of the Owner.

PROPOSAL BOND: A Proposal Bond from a bonding company acceptable to the Owner or a certified check in an amount equal to 10% of the greatest amount proposal **must** accompany each Offeror's proposal.

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

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

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

Subcontractors and Suppliers intending to submit proposals to General Construction Offerors are required to prepare their proposals based on a complete set of proposal documents. If after reviewing the complete set of proposal documents, Subcontractors and Supplier Offerors desire to purchase individual drawings and specification sections for their proposal convenience, they may do so by ordering the specific drawings and specifications directly from the reproduction company. Each Offeror purchasing a partial set of proposal documents is responsible for determining exactly which documents he requires and is responsible for all costs associated with printing and delivery. Subcontractors and Suppliers exercising this option must agree to do so on the basis that 1) all documents shall be returned to the Architect, without refund, after submitting a proposal and 2) documents shall not be used on other construction projects. Successful Subcontractors and Supplier Offerors may retain their Proposal Documents until completion of the construction.

END OF DOCUMENT AA

DOCUMENT AB

INSTRUCTIONS TO OFFERORS

1.1 QUALIFIED OFFERORS

A. Competitive Sealed Proposals will be accepted from qualified Offerors (General Contractors) only for the entire scope of work described in the Contract Documents. As a prerequisite to an Offeror's qualifying for the award of contract on this work, the Offeror must complete each item of the Contractor Information and Experience Statement (AIA Document A305). The Statement forms may be obtained from the Houston Chapter of the American Institute of Architects, 315 Capitol, Suite 120, Houston, Texas 77002, (713) 520-0155. In addition to the information contained in the Statement form, Offerors shall also address the selection criteria issues (Safety Record, Financial Condition, Proposed Team, etc.) listed under the paragraph below for Determination of Successful Respondent and Award of Contract. Two (2) copies of The “Statement of Qualifications” documents shall be delivered to VLK Architects, Inc. office at 20445 TX-249, Suite 350, on or before 5:00 PM on Thursday, December 5, 2024.

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

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

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

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

1.2 OFFEROR’S PRESENTATION

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

B. He agrees that:
   1. Work on the project will begin immediately upon receipt of signed Contract or Notice to Proceed.
   2. Offeror will participate as a team member in cooperation with the Project Architect, Engineers, Owner, and Owners agents and/or consultants.
   3. The Offeror will assign a competent full-time superintendent, to the project, and that superintendent shall be maintained on the project for the duration of the project, subject only to his continuous employment.

4. The Offeror will furnish and pay for a proposal bond in the amount of ten percent (10%) of the contract amount.
5. If awarded, the Offeror shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount.
6. Offeror shall carry and keep in full force for the duration of the Project, insurance coverage as required by the General Conditions and/or Supplementary General Conditions of the Specifications.
7. Each Offeror by making his Proposal represents that his Proposal includes only material and equipment specified in the Proposal Documents and supplemented, if necessary, for a complete and operating system.
8. Where subcontract work is involved and where Acceptable Subcontractors are designated for particular sections or phases of the Work, each Offeror by making his Proposal represents that his Proposal includes only firms designated as Acceptable Subcontractors.
9. Each Offeror (and sub-offeror or supplier submitting a proposal to a Offeror) shall submit an affidavit stating that no asbestos PCBs or lead building materials shall be used.

1.3 PROPOSAL DOCUMENTS

A. Proposal Documents include the Request for Competitive Sealed Proposals, Instructions to Offerors, the Proposal Form, and the proposed Contract Documents, including any Addenda issued prior to receipt of proposals.

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

1.4 PROPOSAL PROCEDURES

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

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

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

D. Proposals will be received through Clear Creek ISD eBid system, https://ccisd.ionwave.net/Login.aspx. on the Owner's Form of Proposal for the work as indicated by the Proposal Documents.

E. The Proposal Form must be accompanied by Proposal Bond or Certified Check in the amount of 10% of the proposal.

F. All proposals must be delivered through Clear Creek ISD eBid system or before the time and date set. Proposals will be received at no other place.

G. A proposal may be withdrawn only upon request by the Offeror or his duly authorized representative, provided such request is received by the Owner at the place designated for receipt of proposals and prior to the time fixed for the opening of proposals. A withdrawal of a proposal shall not be effective unless a written confirmation of the withdrawal is received by the Owner at said place within 48 hours before the time fixed for the opening of proposals. The Proposal Bond will be returned with the proposals if withdrawn in accordance with the above. The withdrawal of a

proposal does not prejudice the right of the Offeror to file a new proposal at the time and place stated. No proposal may be withdrawn after the time fixed for the opening of proposals for a period of 60 days.

1.5 INTERPRETATION OF PROPOSAL DOCUMENTS

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

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

1.6 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

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

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

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

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

1.7 REJECTION OF PROPOSALS

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

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

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

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

1.8 INSURANCE

A. Each Offeror shall include in his proposal the complete cost and shall carry and keep in full force for the duration of the construction and warranty, insurance coverage required under the General Conditions, and Document CB - Supplementary Conditions.

1.9 PERFORMANCE BOND AND PAYMENT BOND

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

1.10 PROPOSAL SECURITY

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

1.11 SUBMISSION OF POST PROPOSAL INFORMATION

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

B. The Selected Offeror shall within five (5) days thereafter submit the following:
   1. A statement of costs for each major item of work included in the proposal as described in Section 01 29 73 – Schedule of Values. Each section of specifications will be considered a major item of work and shall be shown as a separate cost item.

1.12 AWARD OF CONTRACT

A. The Offeror to whom the award is made will be promptly notified. If an Offeror (a) withdraws his proposal within 30 days after the date of time fixed for the opening of proposals in the Request for Competitive Sealed Proposals, or (b) fails or refuses to execute the Agreement, or other required forms within ten (10) days after the same are presented to him for signature, or (c) fails or refuses to furnish properly executed Performance Bond and Certification of Required Insurance within 15 calendar days of execution date of the Agreement, the Owner may award the work to another Offeror or Offerors or may call for new proposals.

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

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

1.13 NOTICE TO PROCEED

A. The Offeror shall not commence work under this Contract until bonds, insurance and badging requirements and procedures are completed for General Contractors and Subcontractors.

1.14 COMPLETION TIME

A. Offerors shall familiarize themselves with the Owners requirements concerning the project schedule as described in Section 01 32 16 of this Project Manual.

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

C. It is therefore expressly agreed as a part of the consideration inducing the Owner to execute this contract that the Owner may deduct liquidated damages from the final payment made to the Contractor for each and every calendar day beyond the agreed date which the Contractor shall require for Substantial Completion of the work included in this contract. It is expressly understood that the said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the work is not completed within the agreed time, or within the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty, said damage being caused by additional compensation to personnel, for loss of interest on money and other miscellaneous increased costs, all of which are difficult of exact ascertainment. Also, any disruption of Owner’s use of the existing facilities or newly completed facilities will also be subject to liquidated damages. Refer to Section 01 32 16 for additional requirements. Delays, disruption of use, failures to complete, and liquidated damages are fully described under Article 8.3 of the Supplementary Conditions.

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

1.15 FELONY CONVICTION NOTIFICATION

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

B. The Offeror shall execute Document AE, Statement of Affirmation and submit with proposal.

1.16 AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

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

B. The Offerors shall execute Document AF, Affidavit of Non-Discriminatory Employment and submit with Proposal. The sub-offerors shall execute Document AF, Affidavit of Non-Discriminatory Employment before commencing work on this Project. Offerors and sub-offerors who have not executed this document will not be eligible to work on this project.

1.17 LIST OF SUBCONTRACTORS

A. The Offeror shall supply a list of the following major subcontractors:
1. Mechanical
2. Electrical
3. Plumbing
4. Casework
5. Door
6. Flooring
7. Food Service Equipment
8. Any other prudent subcontractor.

B. The Offeror shall execute Document AG, List of Subcontractors and submit with their Proposal.

C. Owner reserves the right of refusal on any Subcontractor for which Owner has a reasonable objection.

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

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

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

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

D. Prior to payment of retainage and final payment the Contractor shall furnish a notarized statement enclosed, certifying that no asbestos, lead and PCBs containing materials have been used in the Project.

E. In addition to the Contractor's notarized statement, the Subcontractors shall furnish notarized affidavits that no asbestos, lead, and PCBs containing products have been used in this Project.

1.19 CONFLICT OF INTEREST QUESTIONNAIRE

A. According to Local Government Code, Chapter 176, a person or an agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with any government agency must file a completed Conflict of Interest Questionnaire with the records administrator of the local government not later than the seventh business day after the date that the person begins contract discussions or negotiations with the District or submits to the District an application, response to a request for proposals or bids, correspondence, or another writing related to a potential agreement with the District.

B. All Offeror's and sub-offeror's proposing to do work with the District **must** execute Document AI, Conflict of Interest Questionnaire and submit to the District's Legal Department within seven (7) days of the Proposal Date. This requirement will be waived if the Offeror or sub-offeror has previously submitted such document to the District within the last year. In such case, provide written notification and attach to the Proposal.

1.20 CRIMINAL HISTORY RECORDS

A. Prior to commencing any work on this Project, the Selected Contractor shall certify, on the form provided herein as Document AJ, that for each of its employees who will have direct contact with students, the Selected Contractor has obtained, as required by Texas Education Code Section 22.0834:

1. national criminal history record information from a law enforcement or criminal justice agency for each employee of the Selected Contractor hired before January 1, 2008 who will have direct contact with students; and
2. national criminal history record information from the Texas Department of Safety for each employee of the Selected Contractor hired on or after January 1, 2008 who will have direct contact with students; Fingerprinting is required and shall be provided by the contractor (applicant) and administered through FAST (Fingerprint Applicant Services of Texas) which will be recorded by the District in the FACT (Fingerprint-based Applicant Clearinghouse of Texas). Currently applicant must obtain fingerprinting from L-1 Identity Solutions Company, (888) 467-2080, or schedule an appointment online at: https://tx.ibtfingerprint.com/.

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

C. The Selected Contractor shall execute and submit Document AJ, Certification of Criminal History Record Information Review by Contractor-Employer along with required Schedule 'A' documenting

proposed employees to be working on site, within 10 days after receipt of Notice To Proceed and prior to commencement of Work.

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

E. The Owner reserves the right to determine badging requirements for the project in accordance with the Owner's badging policies and procedures. Offerors and sub-offerors must assume that all workers will have direct contact with students if the project is at an existing campus.

1.21 NON-COLLUSION AFFIDAVIT

A. The Offeror shall execute Document 00 45 19, Non-Collusion Affidavit and submit with Proposal.

1.22 AVAILABILITY OF MATERIALS AND SYSTEMS

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

1.23 DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

A. In determining the Selected Offeror, the Owner will evaluate the information submitted on the Proposal Form, and other selection criteria including, but not limited to the following:
1. Price - 30%
2. The offeror's experience and reputation - 10%
3. The quality of the offeror's goods or services - 10%
4. The impact on the ability of the District to comply with rules relating to historically underutilized businesses - 0%
5. The offeror's safety record - 10%
6. The offeror's proposed personnel and sub-offerors - 30%
7. Whether the offeror's financial capability is appropriate to the size and scope of the project - 10%
8. Any other relevant factor specifically listed in the request for bids, proposals, or qualifications - 0%

A committee consisting of two (2) Clear Creek ISD administrators, two (2) architects, and one (1) construction project manager will make an initial evaluation of the proposals. Its recommendation will be considered by the Clear Creek ISD Board of Trustees ("Board"). The final decision-making authority on the proposals rests with the full Board. Decision-making authority has not been delegated to any person or entity other than the Board.

B. A decision regarding determination of the successful Offeror will be rendered as soon as practicable.

C. Insofar as the Architect's recommendation to the Owner in determining the dollar amount of the Proposal of the responsible Offeror, only the Base Proposal and Alternates will be considered; any monetary deduction proposed for using a Substitute Subcontractor (i.e., not one designated as a Listed Subcontractor) will not be a factor in the Architect's decision on which Offeror to recommend and if it is subsequently decided to accept any Substitute Subcontractor the substitution will be processed by Change Order.

1.24 USE OF ASBESTOS FREE MATERIALS, PRODUCTS AND SYSTEMS

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

1.25 COMPLIANCE WITH GOV’T CODE 552.372

A. The requirements of the Texas Public Information Act, Chapter 552 of the Texas Government Code, Subchapter J, may apply to this bid or contract if it is valued at more than $1 million. The contractor or vendor agrees the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter, including the preservation of all “contracting information” (as defined in 552.003) and the provision, upon request of the governmental entity with whom you are contracting, of all contracting information. Contracting information includes, but is not limited to, records, communications and other documents related to the bid process, contract, payments, receipts, scope of work/services, and performance.

END OF SECTION AB

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1DOCUMENT AC.1

BASE PROPOSAL FORM
CLEAR CREEK INDEPENDENT SCHOOL DISTRICT

Submitted by:_____

Date:_____ Phone No.:_____

To: Mr. Alex Aragon, Director of Facility Services
Clear Creek Independent School District
Education Support Center
2145 W. NASA Blvd.
Webster, TX 77598

Having examined Proposal and Contract Documents prepared by VLK Architects, Inc., dated November 14, 2024, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

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

1. Hold Proposal open for 60 days; however, every effort will be attempted for acceptance to be within 45 days after the date on which proposals are opened.
2. Accept right of Owner to reject any or all proposals, to waive formalities or irregularities and to accept proposal which Owner considers the most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Bid and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this bid.

I. BASE PROPOSAL

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

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

II. ALLOWANCES

Undersigned certifies that the specified allowances are included in the Proposal Bid and agrees that unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

IV. CONTRACT TIME

Undersigned agrees to begin Work on Notice to Proceed and be Substantially Complete by the following:

Phase No. 1: Mechanical Scope of Work: At any campus and at any area where interiors work is included in the work of this Contract, then the work of dual duct box replacement shall not commence in that area until the interiors work in that area is complete. New interiors work shall not be installed in any area of the building that is without air conditioning due to the work of dual duct replacement.

NOTE: THIS PAGE MUST BE SUBMITTED BY 2:00 PM, DECEMBER 12, 2024

Flooring: At all campuses removal of existing flooring and installation of new flooring in the Gymnasiums and Cafeterias shall be commenced not earlier than March 15, 2025, and shall be fully completed and ready for its intended use by the Owner not later than March 23, 2025.

Replacement of Operable Partitions: At all campuses where replacement of operable partitions is in the base bid scope of work or where replacement of operable partitions is included as an Alternate, the removal of said operable partitions shall commence not earlier than March 15, 2025, and shall be fully completed and ready for its intended use by the Owner not later than March 23, 2025.

Phase No. 2: August 3, 2025 for all remaining work.

V. ADDENDA

Undersigned acknowledges receipt of Addenda Nos._____

dated _____, 2024.

VI. GENERAL CONTRACTOR'S PERSONNEL

A. Project Manager: _____

B. Superintendent:_____

C. Assistant Superintendent:_____

D. Project Engineer:_____

E. Other:_____

VII. CHANGES IN THE WORK

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

VIII. LIQUIDATED DAMAGES

Undersigned understands that liquidated damages as defined in AIA Document A201 – 2017 "General Conditions of the Contract for Construction" as modified by the Owner will be included in the form of Agreement between Owner and Contractor and that the contractor will be bound thereto.

Undersigned understands that liquidated damages as defined in Section 00 70 00 pertaining to the submittal information for all serving line equipment will be included in the form of Agreement between Owner and Contractor and that the contractor will be bound thereto.

It is understood that the right is reserved by the Owner to reject any or all bids, or waive any formalities or irregularities in the proposal process.

_____
Authorized Signature

_____

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

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____
Date

END OF DOCUMENT

DOCUMENT AC.2

ALTERNATE PROPOSAL FORM
CLEAR CREEK INDEPENDENT SCHOOL DISTRICT

Submitted by:_____

Date:_____ Phone No.:_____

To: Mr. Alex Aragon, Director of Facility Services
Clear Creek Independent School District
Education Support Center
2145 W. NASA Blvd.
Webster, TX 77598

Having examined Proposal and Contract Documents prepared by VLK Architects, Inc., dated November 14, 2024 and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

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

1. Hold Proposal open for 60 days; however, every effort will be attempted for acceptance to be within 45 days after the date on which proposals are opened.
2. Accept right of Owner to reject any or all proposals, to waive formalities or irregularities and to accept proposal which Owner considers the most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Bid and accepted Alternate Proposals.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By signing, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this bid.

ALTERNATES

A1 Alternate No. 1: State in the proposal form the amount to add to or deduct from the Base Proposal for the Proposed Team. This alternate is intended to provide the Contractor the opportunity to adjust the Base Proposal up or down based upon the proposed subcontractors submitted along with Alternate proposals.

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A2 Alternate No. 2: State in the proposal form the amount to deduct from the Base Proposal if the same General Contractor is selected for both CCISD Priority Repairs projects. Each project will require a separate general contracting team and separate installers for carpet and vinyl for each project.

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

NOTE: THIS PAGE MUST BE SUBMITTED BY 3:00 PM, DECEMBER 12, 2024

A3 Alternate No. 3 (Falcon Pass, Goforth, Robinson): State in the proposal form the amount to add to or deduct from the base proposal for porcelain tile wainscot throughout the main corridor as shown by drawings and as specified. Remove and reinstall all fixed equipment and furniture at partitions scheduled to receive installation of wainscot. If wainscot is accepted, then corner guards are to be omitted from scope of work

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A4 Alternate No. 4 (Falcon Pass, Goforth, Robinson): State in the proposal form the amount to add to or deduct from the base proposal for porcelain tile wainscot at the front entrance and library entry as shown by drawings and as specified. Remove and reinstall all fixed equipment and furniture at partitions scheduled to receive installation of wainscot. Remove wood chair railing edging. Remove and reinstall shelving if needed. If wainscot is accepted then corner guards are to be omitted from the scope of work

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A5. Alternate No. 5 (Robinson): State in the proposal form the amount to be added to the base proposal for vinyl wall covering as shown by drawings and as specified. Tape and float existing demountable partition. Install vinyl wall covering throughout. Remove and reinstall all room signage if vinyl wallcovering is being Installed.

_____DOLLARS

(ADD $_____)

A6. Alternate No. 6 (Falcon Pass, Goforth, Robinson): State in the proposal for the amount to add to the base proposal to replace existing Vent-A-Kiln system at each campus like for like. Scope of work to be limited to the equipment, ductwork reconnection, power reconnection, and any ceiling or wall repairs from the replacement of the system

_____DOLLARS

(ADD $_____)

A7. Alternate No. 7 (Falcon Pass, Goforth, Robinson): State in the proposal form the amount to add to the base proposal to repaint throughout the building as shown by drawings and as specified, including handrails and exposed structure.

_____DOLLARS

(ADD $_____)

A8. Alternate No. 8 (Goforth): State in the proposal form the amount to add to the base proposal to replace the existing partition with manual folding partition.

_____DOLLARS

(ADD $_____)

UNIT PRICES: None in this Project

PROPOSED SUBCONTRACTORS: The undersigned proposes the following subcontractors. Owner has right of refusal for proposed subcontractors.

Ceramic Tile: _____

Concrete: _____

Doors/Hardware: _____

Earthwork: _____

Electrical: _____

Fire Alarm: _____

Fire Sprinkler: _____

Flooring: _____

Local Sound: _____

Mechanical: _____

Painting: _____

Plumbing: _____

NOTE: THIS PAGE MUST BE SUBMITTED BY 3:00 PM, DECEMBER 12, 2024

Upon receipt of notice of acceptance of this proposal within 45 days after the opening of alternate proposals, I (we) agree to execute formal contract forms, acceptable surety bonds, and required insurance certificates within five days of receipt of the Contract.

Should I (we) fail to execute and deliver the Contract, along with the satisfactory surety bonds and insurance certification within the time set forth, the proposal security, attached hereto without endorsement, shall become the property of Clear Creek Independent School District as liquidated damages for the delay caused and the additional work required.

_____
Respectfully submitted, (Signature)

_____
By (Please Print or Type)

_____
Title

_____
Contractor

_____
Business Address

_____
Telephone Number

Indicate whether - Individual
Partnership
Corporation

ATTEST:

_____

NOTE: THIS PAGE MUST BE SUBMITTED BY 3:00 PM, DECEMBER 12, 2024

DOCUMENT AD - PROPOSAL BOND

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

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Proposal, being for the Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson project, the kind and extent of work involved being set forth in detail in the proposed Contract Documents cited herein.

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

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this _____ day of _____, 2024, the name and Corporate Seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

_____ _____
Business Address Individual Principal

_____ _____
Business Address Individual Principal

ATTEST:

_____ BY: _____
Secretary President

_____ _____
Business Address Corporate Surety

ATTEST: _____ BY: _____

END OF DOCUMENT

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

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NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

DOCUMENT AE - FELONY CONVICTION NOTIFICATION

Note: <u>The Statement of Affirmation Must Be Notarized</u>

STATEMENT OF AFFIRMATION

"The undersigned affirms that he/she is duly authorized to provide this information by the person(s) or business entity making the bid, and the information provided below concerning felony convictions has been personally and thoroughly reviewed, and verified, and is, therefore, current, true and accurate to the best of my knowledge."

Firm's
Name:_____Address:_____

"a.____ My firm is a publicly held corporation, therefore, this reporting requirement is not applicable."
"b.____ My firm is not owned nor operated by anyone who has been convicted of a felony."
"c.____ My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:"

Name of Felon(s)
_____

Details of Conviction(s) _____

_____

PLEASE CHECK a, b, or c ABOVE AND SIGN BELOW

Offeror's
Name _____ Position/Title _____

Offeror's
Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____

_____
Notary Public

My Commission Expires: _____

END OF DOCUMENT AE

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

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NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

FELONY CONVICTION NOTIFICATION

DOCUMENT AF - AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

STATE OF TEXAS)
)
COUNTY OF)

AFFIDAVIT

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

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF)

Sworn to and subscribed before me at _____, Texas, this the _____ day of _____, 2024.

_____
Notary Public in and for [ ] County, Texas

END OF DOCUMENT AF

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

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NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

DOCUMENT AH

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

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

PROJECT: MULTI CAMPUS PRIORITY REPAIRS FAPE GOFE ROBE
Falcon Pass ES; 2465 Falcon Pass; Houston, Texas 77062
Goforth ES; 2610 Webster St; League City, Texas 77573
Robinson ES; 451 Kirby Rd; Seabrook, Texas 77586

ARCHITECT:
VLK ARCHITECTS, INC.
20445 TX-249, SUITE 350
HOUSTON, TEXAS 77070

ARCHITECT'S PROJECT NO. 24-046.00

CONTRACTOR: _____ DATE: _____

(Name, address) _____

_____

AFFIDAVIT

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

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF _____)

Sworn to and subscribed before me at _____, Texas, this the _____ day of _____, 2024.

_____
Notary Public in and for _____ County, Texas

END OF DOCUMENT AH

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED AT PROJECT CLOSE-OUT

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NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED AT PROJECT CLOSE-OUT

DOCUMENT AI

CONFLICT OF INTEREST QUESTIONNAIRE

INSTRUCTIONS

According to Local Government Code, Chapter 176, a person or an agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with Clear Creek Independent School District must file a completed Conflict of Interest Questionnaire with the District Legal Department not later than the seventh business day after the date that the person begins contract discussions or negotiations with the District or submits to the District an application, response to a request for bids, correspondence, or another writing related to a potential agreement with the District.

This Conflict of Interest Questionnaire must be filed annually by September 1 as long as the person or the agent of the person continues to contract or seek to contract for the sale or purchase of property, goods, or services with the District or not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.

The completion of the Conflict of Interest Questionnaire is not needed if the person is an employee of a governmental entity and is acting in the employee's official capacity.

Explanation of the Conflict of Interest Questionnaire

1. Name of person doing business with the District.
2. Check the box if you are filing an update to a previously filed questionnaire.
3. Describe each affiliation or business relationship with an employee or contractor of the District who makes recommendations to a District officer with respect to expenditure of money. **If no affiliation or business relationship exists, state "NONE."**

   Examples:

   If your spouse, parent, or child is the District's Director of Purchasing and a bid is being submitted to the Purchasing Department, this relationship must be reported.

   If your spouse, parent, or child is the Principal at a School and your business may sell items directly to that school, this relationship must be reported.

   If you or your spouse, parent, or child is in business with a District employee that would be making a recommendation concerning a purchase or sales transaction involving you, the relationship must be reported.

   If you employ or do business with a spouse, parent, or child of a District employee that would be making a recommendation concerning a purchase or sales transaction involving you, the relationship must be reported.

   If you are a District employee and would be making a recommendation concerning a purchase or sales transaction involving you, the relationship must be reported.

   If your spouse, parent, or child is a teacher that does not make recommendations concerning purchasing or sales transactions, this relationship should not be reported.

   If your spouse, parent, or child is a Principal at a School and a bid is being considered by a separate department such as Facilities Planning (Construction Department), this relationship should not be reported.

4. Describe each affiliation or business relationship with a person who is a District officer and who appoints or employs a District officer that is the subject of this questionnaire. **If no affiliation or business relationship exists, state "NONE."**

   Example:

   If you or your spouse, parent, or child is related to, employs, or is in business with a District officer or their spouse, parent, or child, this relationship must be reported.

5. Name of District officer with whom you have an affiliation or business relationship.

   For each person listed under question #4, complete page 2. If answers to A, B, and C are NO, indicate the name of the District officer, but do not complete section D.

6. Describe any other affiliation or business relationship that might cause a conflict of interest.

   Example:

   If your neighbor or friend is a District employee that would be making a recommendation concerning a purchase or sales transaction involving you and you feel that your relationship with this employee could affect their recommendation, this relationship must be reported.

   If any other situation exists that would result in a conflict of interest, the relationship must be reported.

7. Sign and date this form.

Submit the completed form to the District. If any disclosures are indicated under questions #3 or #4, the form will be posted on the District's website.

INSERT CONFLICT OF INTEREST QUESTIONNAIRE

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.

DOCUMENTS AJ

CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION

REVIEW BY CONTRACTOR-EMPLOYER

Certifying Affidavit submitted to:

Name of School District: _____

Mailing Address: _____
_____

Project: _____
_____

STATE OF TEXAS §

COUNTY OF §

(1) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to Clear Creek Independent School District (the "District") that such firm has obtained, reviewed and verified, from a law enforcement or criminal justice agency or a private entity that is consumer reporting agency governed by the Fair Credit Reporting Act (15 U.S.C. §§ 1681 et seq.) the criminal history record information of all employees hired ***before January 1, 2008,*** who (a) have or will have continuing duties related to the contracted services, and (b) have or will be on school campuses. Such employees are identified by name on Schedule A attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule A have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(2) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to the District, that such firm has obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse, the national criminal history record information of all employees hired ***on or after January 1, 2008,*** who (a) have or will have continuing duties related to the contracted services, and (b) be on school campuses. Such employees are identified by name on Schedule B attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule B have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(3) The undersigned firm swears and covenants that no present or future employee will provide services to the Project that involve direct contact with students unless and until such employee's national criminal history record information has been reviewed and cleared as required by Paragraph (2) above, and an updated Certification has submitted by the contracting firm to the District with an updated Schedule B identifying such employees. In the event of an emergency, an employee who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District representative.

(4) The undersigned firm swears and covenants that, upon receipt of information, directly or indirectly, that any employee of the contracting firm has been convicted of an offense identified in Section 22.085 of

the Texas Education Code, the contracting firm will immediately remove such employee from the Project and notify the District.

(5) Furthermore, the name, driver's license number, date of birth, and any other information required by the DPS will be submitted to the District for any person on either Schedule A or Schedule B for the purposes of subscribing to and issuing a District badge.

_____, being duly sworn, affirms and certifies that he/she is the

_____ (position) of _____(contracting

firm), and that all statements and acknowledgements contained herein are true and correct, and that he/she has the authority to bind such firm to the covenants set out above.

_____

SUBSCRIBED AND SWORN TO BEFORE ME this _____ day of _____, 2024.

Notary Public _____ State of _____

My Commission Expires: _____

DOCUMENT AK

RELEASE OF LIEN DOCUMENTS

Lien documents follow this page.

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APPENDIX

STATUTORY LIEN WAIVER FORMS

1. **CONDITIONAL WAIVER FOR PROGRESS PAYMENTS**
2. **UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS**
3. **CONDITIONAL WAIVER FOR FINAL PAYMENT**
4. **UNCONDITIONAL WAIVER FOR FINAL PAYMENT**

[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: Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson

Architect Job No.: 24-046.00

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: Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson

Architect Job No.: 24-046.00

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: Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson

Architect Job No.: 24-046.00

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: Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson

Architect Job No.: 24-046.00

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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NON-COLLUSION AFFIDAVIT

STATE OF TEXAS)
)
COUNTY OF)

I state that I am the _____ (Title) of _____ (Name of Firm) and that I am authorized to make this affidavit on behalf of my firm, and its owners, directors, and officers. I am the person responsible in my firm for the prices(s) and the amount of this proposal.

I state that:

1. The price(s) and amount of this proposal have been arrived at independently and without consultation, communication or agreement with any other contractor, proposer or potential proposer.

2. Neither the price(s) nor the amount of this proposal, and neither the approximate price(s) nor approximate amount of this proposal, have been disclosed to any other firm or person who is a proposer or potential proposer, and they will not be disclosed before the proposal submission date.

3. No attempt has been made or will be made to induce any firm or person to refrain from proposing on this contract, or to submit a proposal higher than this proposal, or to submit any intentionally high or noncompetitive proposal or other form of complementary proposal.

4. The proposal of my firm is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive proposal.

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF)

Sworn to and subscribed before me at _____, Texas, this the _____ day of _____, 2024.

_____
Notary Public in and for [ ] County, Texas

END OF DOCUMENT

NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

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NOTE: THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL

DOCUMENT 00 40 00 AR - CERTIFICATE OF INTERESTED PARTIES

CERTIFICATE OF INTERESTED PARTIES – FORM 1295

Certificate of Interested Parties (Form 1295): Electronically complete and submit using the Texas Ethics Commission's online filing application. Print a copy of Form 1295, sign, have notarized, and, with a copy of the Certificate of Filing, attach to Document 00 12 00 Bid Solicitation.

Clear Creek Independent School District is required to comply with House Bill 1295, which amends the Texas Government Code by adding Section 2252.908, Disclosure of Interested Parties. Section 2252.908 prohibits ***Clear Creek Independent School District*** from entering into a contract resulting from a RFP with a business entity unless the business entity submits a Disclosure of Interested Parties (Form 1295) to ***Clear Creek Independent School District*** at the time business entity submits the signed contract. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Texas Ethics Commission.

Definitions:

1. Interested Party: A person:
   a) who has a controlling interest in a business entity with whom ***Clear Creek Independent School District*** 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.
2. Business Entity: An entity recognized by law through which business is conducted, including a sole proprietorship, partnership, or corporation.

As a business entity, each vendors must electronically complete, print, sign, notarize, and submit Form 1295 and the Certification of Filing with their proposals even if no interested parties exist.

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

Submit the completed Form 1295 with the certification of filing with ***Clear Creek Independent School District*** by attaching the completed form to the vendor's solicitation response.

Clear Creek Independent School District must acknowledge the receipt of the filed Form 1295 by notifying the Texas Ethics Commission of the receipt of the filed Form 1295 no later than the 30th day after the date the contract binds the parties to the contract. After ***Clear Creek Independent School District*** acknowledges the Form 1295, the Texas Ethics Commission will post the completed Form 1295 to its website within seven business days after receiving notice from ***Clear Creek Independent School District***.

SAMPLE FORM 1295

CERTIFICATE OF INTERESTED PARTIES — FORM 1295

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY

1 **Name of business entity filing form, and the city, state and country of the business entity's place of business.**

2 **Name of governmental entity or state agency that is a party to the contract for which the form is being filed.**

3 **Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the goods or services to be provided under the contract.**

4 Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 **Check only if there is NO Interested Party.** ☐

6 **AFFIDAVIT**

I swear, or affirm, under penalty of perjury, that the above disclosure is true and correct.

_____
Signature of authorized agent of contracting business entity

AFFIX NOTARY STAMP / SEAL ABOVE

Sworn to and subscribed before me, by the said _____, this the _____ day of _____, 20 _____, to certify which, witness my hand and seal of office.

_____ _____ _____
Signature of officer administering oath | Printed name of officer administering oath | Title of officer administering oath

ADD ADDITIONAL PAGES AS NECESSARY

Form provided by Texas Ethics Commission www.ethics.state.tx.us Adopted 10/5/2015

END OF DOCUMENT AR

DOCUMENT BA

CONTRACT DOCUMENTS

I. CONSTRUCTION CONTRACT AGREEMENT

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

II. CONDITIONS OF THE CONTRACT

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

III. AVAILABILITY

A. Printed copies of these documents may be examined in the Architect's office.

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

END OF DOCUMENT

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DOCUMENT BB

TEXAS STATUTORY PERFORMANCE BOND **Bond No.: _____**
(Penalty of this bond must be 100% of contract amount)

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

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of _____ , 2024, for

Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson

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 _____, 2024.

(Seal)
_____

_____
Principal

_____
Surety Address

By: _____

(Seal)
_____
Surety Telephone Number

_____
Surety

By: _____
Attorney-in-Fact

END OF DOCUMENT

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DOCUMENT BC

TEXAS STATUTORY PAYMENT BOND **Bond No.: _____**
(Penalty of this bond must be 100% of contract amount)

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

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the ____ day of _____ , 2024, for

MULTI CAMPUS PRIORITY REPAIRS FOR FALCON PASS, GOFORTH, AND ROBINSON

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 _____ , 2024.

_____(Seal)
Witness: Principal

_____ By: _____

Witness: _____ (Seal)
Surety

_____ By: _____
Attorney-in-Fact

_____

_____ _____
Surety Address Surety Telephone Number

END OF DOCUMENT

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AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Clear Creek Independent School District
2425 East Main Street
League City, Texas 77573

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

Multi-Campus Priority Repairs FAPE, GOFE, & ROBE
Clear Creek Independent School District
VLK Project No.: 24-046.00

The Architect:
(Name, legal status, address and other information)

VLK Architects, LLC
20445 State Highway 249, Suite 350
Houston, Texas 77070

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

_____ Per day, as set forth in Section 8.3.4 of the AIA Document A201

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Five Percent (5%)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

At the Owner's sole discretion

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest in accordance with Chapter 2251 of the Texas Government Code
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[X] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

N/A

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in Article 11 of AIA Document A201™–2017, General Conditions of the Contract for Construction, as modified by the Owner , and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in Article 11 of AIA Document A201™–2017, General Conditions of the Contract for Construction, as modified by the Owner, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A201™–2017, General Conditions of the Contract for Construction, as modified by Owner

.3 :
(Insert the date of the E203-2013 incorporated into this Agreement.)

N/A

.4 Drawings

Number	Title	Date

.5 Specifications

Section	Title	Date	Pages

.6 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.7 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ]

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.8 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

Additions and Deletions Report for

AIA® Document A101® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 14:44:27 CT on 11/15/2024.

PAGE 1

Clear Creek Independent School District
2425 East Main Street
League City, Texas 77573

...

Multi-Campus Priority Repairs FAPE, GOFE, & ROBE
Clear Creek Independent School District
VLK Project No.: 24-046.00

...

VLK Architects, LLC
20445 State Highway 249, Suite 350
Houston, Texas 77070
PAGE 2

~~**EXHIBIT A INSURANCE AND BONDS**~~
PAGE 3

_____ Per day, as set forth in Section 8.3.4 of the AIA Document A201
PAGE 4

Five Percent (5%)
PAGE 5

At the Owner's sole discretion

...

Payments due and unpaid under the Contract shall bear interest ~~from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~in accordance with Chapter 2251 of the Texas Government Code
PAGE 6

[**X**] Litigation in a court of competent jurisdiction

...

N/A
PAGE 7

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in ~~AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds,~~ Article 11 of AIA Document A201™–2017, General Conditions of the Contract for Construction, as modified by the Owner , and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in ~~AIA Document A101™–2017 Exhibit A,~~ Article 11 of AIA Document A201™–2017, General Conditions of the Contract for Construction, as modified by the Owner, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with ~~a building information modeling exhibit,~~ AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with ~~a building information modeling exhibit,~~ AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

...

.2 AIA Document ~~A101™–2017, Exhibit A, Insurance and Bonds~~

~~**.3** AIA Document~~ A201™–2017, General Conditions of the Contract for ~~Construction~~Construction, as modified by Owner

~~**.4** Building information modeling exhibit, dated as indicated below:~~**.3** :
(Insert the date of the ~~building information modeling exhibit~~ E203-2013 incorporated into this Agreement.)

N/A

~~**.5**~~ **.4** Drawings

...

~~**.6**~~ **.5** Specifications

...

~~**.7**~~ **.6** Addenda, if any:

...

~~**.8**~~ **.7** Other Exhibits:

PAGE 8

[ ] ~~AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:~~
~~(Insert the date of the E204-2017 incorporated into this Agreement.)~~

...

~~**.9**~~ **.8** Other documents, if any, listed below:

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:44:27 CT on 11/15/2024 under Order No. 3104238995 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ – 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Multi-Campus Priority Repairs FAPE, GOFE, & ROBE
VLK Project No.: 24-046.00

THE OWNER:
(Name, legal status and address)

Clear Creek Independent School District
2425 East Main Street
League City, Texas 77573

THE ARCHITECT:
(Name, legal status and address)

VLK Architects, LLC
20445 State Highway 249, Suite 350
Houston, Texas 77070

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions or recommendations on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

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

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.
.2 The Agreement. (AIA Document A101-2017)
.3 The Supplementary Conditions to the A201-2017 General Conditions
.4 The General Conditions of the Contract for Construction
.5 Addenda, with those of later date having precedence over those of earlier date
.6 Drawings and Specifications

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

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

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not

use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

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

(Paragraph deleted)

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 1.9 MISCELLANEOUS OTHER DEFINITIONS

§ 1.9.1 ADDENDA, ADDENDUM

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

§ 1.9.2 ALTERNATE PROPOSAL(S)

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

§ 1.9.3 APPROVED, APPROVED EQUIVALENT, APPROVED EQUAL, OR EQUAL

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

§ 1.9.4 BASE PROPOSAL

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

§ 1.9.5 CONTRACT TIME

The period of which is established in the Contract Documents for Substantial Completion of the Work.

§ 1.9.6 DATE OF AGREEMENT

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

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

§ 1.9.8 DATE OF FINAL COMPLETION
The end of construction. See AIA Document A201, Section 9.10.

§ 1.9.9 DAY
The following days are referenced in the documents:

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

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

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

.4 No time extensions will be allowed due to inclement or adverse weather days.

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

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

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

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

ARTICLE 2 OWNER

§ 2.1 General

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

(Paragraph deleted)

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract.

(Paragraphs deleted)

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

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

§ 2.6 OWNER'S LACK OF LIABILITY TO THIRD PARTY

§ 2.6.1 The Owner is not responsible for the acts and/or omissions of, or contractually involved with, any subcontractors, suppliers of labor or materials, and/or their respective employees or agents or any other third-party claimants. Such claimants shall not constitute third party beneficiaries under this contract. The Contractor and/or his

Surety solely shall deal with, take responsibility for, and be liable to such parties under this Contract. Contractor will indemnify and defend the Owner from any legal actions against Owner for unpaid bills of subcontractors.

§ 2.7 OWNER'S RIGHT TO OCCUPY THE PROJECT

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

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

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the

Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

§ 3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work.

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

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

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

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

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

§ 3.3.6 Any time that the Contractors' employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for or on behalf of the Contractor or any of its subcontractors are on site,

the work shall be supervised by a qualified employee of the Contractor.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

- **.1** If, after award of contract, the Contractor of one of his Subcontractors, or Suppliers determines that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed substantiation for his position. Any changes deemed necessary by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accompanied by appropriate Modification.
- **.2** After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.
- **.3** Requests for substitution, received by the Architect later than forty five (45) days after "Notice to Proceed" or "Date of Commencement of the Work" (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.
- **.4** By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor
  - **.1** represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;
  - **.2** represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
  - **.3** certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
  - **.4** will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
- **.5** Substitution requests shall be submitted on the forms included herein and in accordance with the process established in specification referring to Product Options and Substitutions.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

- **.1** State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.
- **.2** State law prohibits weapons or firearms on school property.
- **.3** There shall be zero tolerance for fraternization with students, teachers and any other Owner personnel, Contractor will immediately remove any employee that violates this provision from the project.
- **.4** No glass bottles shall be brought on the construction site or Owner's property by any construction personnel.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new, unless the Contract Documents require or permit otherwise. The contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of Work the Contract Documents require or permit. Work, materials, or

equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect cause by abuse, material alteration to the Work not executed by the Contractor, insufficient maintenance or maintenance not in compliance with written instructions therefor, operation not in compliance with written instructions therefor, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

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

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

- **.1** The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar utility connection charges.
- **.2** The Contractor shall pay directly all temporary utility charges (excluding permanent power), utility district/company inspection fees, temporary tap charges, and temporary water meter charges and any other similar fees assessed by jurisdictional authority having control over this Project. The Contractor shall secure and pay for all governing authorities' permit fees.
- **.3** Fees payable to the Texas Department of Licensing and Regulation (TDLR) for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner and the Architect will submit the documents to the TDLR for review and approval.
- **.4** The Contractor shall pay all SWPPP related costs.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum or GMP all allowances stated in the Contract documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct and approve in writing.

(Paragraphs deleted)

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent, project manager and necessary assistants who shall be in attendance at the Project site during performance of the Work, including Punch List work. The superintendent and project manager shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications given to the superintendent or project manager shall be binding as if given to the Contractor.**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

(Paragraph deleted)

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's

construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

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

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

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and

coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been accepted by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's acceptance thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's acceptance of a resubmission shall not apply to such revisions.

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

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

§ 3.12.12 The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his

consultants. Samples shall be submitted directly to the Architect for review.

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

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

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

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

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

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

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

- **.1** defects in plans, designs or specifications prepared, approved or used by the Architect; or
- **.2** negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:
  - **.1** personal injury or death;
  - **.2** property injury; or
  - **.3** any other expense that arises from personal injury, death or property injury.

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

§ 3.20 PREVAILING WAGE RATES

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

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

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

§ 3.21 ANTITRUST VIOLATIONS

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

§ 3.22 THIRD-PARTY BENEFICIARY

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

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the work, and (3) to determine in general if the work is being performed in a manner indicating that the work, when fully completed, will be in accordance with the Contract documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

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

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure Authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

(Paragraph deleted)

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor. Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution. Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the

proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, but only to the extent permitted by law.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based on agreement among the Owner, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents. A Construction Change Directive requires agreement by the Owner or the Owner's representative and Architect, and may or may not be agreed to by the Contractor; an order for a minor change may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

§ 7.5 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

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

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

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

- **.1** For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor or Sub-subcontractor's own forces, ten percent (10%) of the cost.
- **.2** For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.

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

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

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

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

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

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4.

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

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

§ 7.5.5 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

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

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

§ 8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to Two Thousand Five Hundred Dollars ($2,500.00) per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. The liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadline for substantial completion and Contractor's achievement of substantial completion.

§ 8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, within ninety (90) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to Five Hundred Dollars ($500.00), per phase, for each and every Calendar Day beyond the 90-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial Completion is not achieved by the agreed contract completion date, the Project close-out period of ninety (90) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

§ 8.3.6 Extensions of time granted for causes described herein will be granted on the basis of 1.4 Calendar Days extension for each Regular Working Day lost.

§ 8.3.7 Each Bidder shall include in his proposed Contract Time an adequate allowance of inclement or adverse

weather days. Contractor shall not be entitled to any extensions of the Contract Time adjustment to the Contract Sum due to inclement or adverse weather.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

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

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

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

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

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

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

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

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

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

§ 9.3 Applications for Payment

§ 9.3.1 No later than 3 working days prior to the first Wednesday of each month, submit an itemized Application for Payment, supported by such data sustaining the Contractor's right to payment as the Owner or Architect may require, and reflecting retainage, as provided elsewhere in the Construction Documents. Information on the form shall be divided into the same last day of the month preceding, which shall also be the basis of payment or as agreed by the Owner, Contractor and Architect by verification at the site, prior to submittal.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in

the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

(Paragraph deleted)

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

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

.2 The location must be a bonded warehouse.

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

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

Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment. The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.3.4 The Contractor shall submit requests for payment in duplicate, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

.5 damage to the Owner or a Separate Contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make progress payments in accordance with the following Section which shall be inserted as Article 5, Progress Payments, in the Owner-Contractor Agreement, AIA Document A101, 2017 Edition.

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

.2 Not later than twenty (20) working days following the first Wednesday of each month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner. Applications for Payment shall be submitted by the first Wednesday of the month.

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

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent

(5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within ten days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within ten days after the date established in the Contract Documents, the amount certified by the Architect, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Should the Architect determine that the Contractor's List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

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

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

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

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

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

§ 9.8.7 After the date of Substantial Completion of the Project is evidenced by the Certificate of Substantial Completion, the Contractor will be allowed a period of time within which to correct all deficiencies attached to the Certificate of Substantial Completion as outlined in Section 8.3.4 of these supplementary conditions. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the contractor's surety. In this report, the Contractor and surety will be informed that, should correction remain incomplete for fifteen (15) days, the

Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Article 14.2.

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

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that

portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor thirty-one (31) days after Substantial Completion of the Work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, and the Final Certificate for Payment has been issued by the Architect. The final payment will not be made until all of these conditions have been satisfied.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.2.9 The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.

§ 10.2.10 The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in section 10.3.2.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

(Paragraphs deleted)

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a governmental agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all costs and expenses thereby incurred, but only to the extent provided by law.

§ 10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

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

(Paragraphs deleted)

§ 11.2 The Owner requires the following minimum insurance coverages:

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

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

Coverage shall include the following:

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

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

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

§ 11.2.3 Workers' Compensation — Statutory Limits

(a) Coverage at Statutory Limits with All States Endorsement
(b) Employer's Liability — Each Accident $1,000,000.00; Disease (Policy Limit) $1,000,000.00; Disease (Each Employee) $1,000,000.00
(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

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

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

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

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

§ 11.2.5 Additional Requirements for Architects, Engineers and Design Professionals (each a "Professional"):

(a) Professional Liability policy limits shall be one (1) times compensation amount due such Professional under the Contract, subject to a minimum limit of $1,000,000.00 and a maximum limit of $25,000,000.00.

(b) Professional Liability policies issued on a "claims made" basis must have a retroactive date shown on the certificate preceding date of contract. Such policies must include an Extended Reporting Period three years past completion of construction contract.

(c) Minimum coverage for excess (umbrella) insurance for Architects, Engineers and Design Professionals shall be one (1) times compensation amount due such Professional under the Contract, subject to a minimum limit of $1,000,000.00 and a maximum limit of $425,000,000.00. To the extent of Commercial General Liability coverage for the Professional exceeds $1,000,000.00, such amount may be used as a credit against the Excess (Umbrella) Insurance requirement set out in the preceding sentence.

§ 11.2.6 Insurance Limits for Consultants hired by a Professional

(a) Notwithstanding Section 11.1.2.1 above, Consultants shall have the following minimum insurance requirements:

(1) Worker's Compensation:	Statutory Limits	
Employer's Liability	Each Accident	$1,000,000.00
	Disease (Policy Limit)	$1,000,000.00
	Disease (Each Employee)	$1,000,000.00
(2) Commercial General Liability	General Aggregate	$1,000,000.00
	Products/Completed Operation Aggregate	$1,000,000.00
	Bodily Injury and Property Damage (each)	$1,000,000.00
	Personal and Advertising Injury	$1,000,000.00
(3) Automobile Liability	Per Person/Accident	$1,000,000.00
(4) Professional Liability	Program Limits, If applicable	$1,000,000.00

Professional Liability policies issued on a "claims made" basis must have a retroactive date shown on the certificate preceding date of contract. Such policies must include an Extended Reporting Period three years past completion of Construction Contract.

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

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

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

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

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

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

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

thereafter.

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

.8 All insurance except Professional Liability must be issued on an occurrence basis.

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

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

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

(Paragraphs deleted)

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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

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

§ 11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

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

§ 11.5 WORKER'S COMPENSATION INSURANCE COVERAGE

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

§ 11.5.2 DEFINITIONS:

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

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

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include without limitation, providing

hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

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

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

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

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

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

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

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

§ 11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

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

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

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

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

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

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

.1 A certificate of coverage, prior to the other person beginning work on the project, and

.2 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 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project, and

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

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor. In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

§ 12.3.1 If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 EQUAL OPPORTUNITY

§ 13.7.1 The contractor shall maintain policies of employment as follows:

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

§ 13.8 CRIMINAL BACKGROUND CHECKS

If applicable to the project site, the Contractor/Subcontractor shall certify compliance with Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117 related to criminal background checks for contractor and subcontractor employees or ensure compliance with the Owner's LEE Fast Pass Procedure for obtaining such criminal background check, as required by any Criminal History Certification provided by Owner .

§ 13.9 REQUIRED CERTIFICATIONS AND VERIFICATIONS

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law. Contractor further certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating

business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

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

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

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

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the

other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within ninety (90) days after occurrence of the event giving rise to such Claim or within ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 Adverse weather conditions shall not be the basis for additional time or additions to the Contract Sum.

(Paragraphs deleted)

§ 15.2 Initial Decision

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

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

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

(Paragraphs deleted)

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

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

§ 15.3 Mediation

§ 15.3.1

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

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

(Paragraphs deleted)

§ 15.4.4 Consolidation or Joinder

(Paragraphs deleted)

Additions and Deletions Report for
AIA® Document A201® – 2017

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 14:47:49 CT on 11/15/2024.

PAGE 1

Multi-Campus Priority Repairs FAPE, GOFE, & ROBE
VLK Project No.: 24-046.00

...

Clear Creek Independent School District
2425 East Main Street
League City, Texas 77573

...

VLK Architects, LLC
20445 State Highway 249, Suite 350
Houston, Texas 77070

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

...

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

...

The Initial Decision Maker is the person identified in the Agreement to render initial decisions or recommendations on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

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

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.
.2 The Agreement. (AIA Document A101-2017)
.3 The Supplementary Conditions to the A201-2017 General Conditions
.4 The General Conditions of the Contract for Construction
.5 Addenda, with those of later date having precedence over those of earlier date
.6 Drawings and Specifications

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

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

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§ 1.6.1 ~~Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and~~ Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer at the corporation for which is was intended, or if delivered at or sent by certified mail, or by registered or certified mail, or by courier service providing proof of delivery, to the last business address known to the party giving notice, or if delivered by facsimile or other electronic communications to the offices of the person or corporation for which it was intended. For facsimiles or other electronic communications received after 5:00 p.m. on a business day, or on a weekend or legal holiday on which the recipient's offices are closed, notice shall be deemed to have been duly served ~~if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.~~on the next business day.

§ 1.6.2 ~~Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.~~

The parties shall agree upon ~~written~~ protocols governing the transmission and use ~~of, and reliance on,~~ of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

...

Any use of, or reliance on, all or a portion of a building information model without agreement to ~~written~~ protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

§ 1.9 MISCELLANEOUS OTHER DEFINITIONS

§ 1.9.1 ADDENDA, ADDENDUM

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

§ 1.9.2 ALTERNATE PROPOSAL(S)

A separate amount stated on a separate Proposal Form which, if accepted by the Owner, will be added to or deducted

from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

§ 1.9.3 APPROVED, APPROVED EQUIVALENT, APPROVED EQUAL, OR EQUAL

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

§ 1.9.4 BASE PROPOSAL

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

§ 1.9.5 CONTRACT TIME

The period of which is established in the Contract Documents for Substantial Completion of the Work.

§ 1.9.6 DATE OF AGREEMENT

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

§ 1.9.7 DATE OF COMMENCEMENT OF THE WORK

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

§ 1.9.8 DATE OF FINAL COMPLETION

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

§ 1.9.9 DAY

The following days are referenced in the documents:

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

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

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

.4 No time extensions will be allowed due to inclement or adverse weather days.

§ 1.9.10 NOTICE TO PROCEED

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

§ 1.9.11 PROVIDE

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

§ 1.9.12 PUNCH LIST

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

§ 1.9.13 UNIT PRICES

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

or his subcontractors."

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§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. ~~The Owner shall designate in writing a representative who shall have express~~ All parties understand that only the Board of Trustees for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the ~~Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority.~~ Board's approval under current policy of the Board of Trustees for the Owner, including, but not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.

~~**§ 2.1.2** The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.~~

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. ~~The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.~~

~~**§ 2.2.2** Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~

~~**§ 2.2.3** After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.~~

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If the Contractor defaults or neglects to carry out the ~~Work~~ work in accordance with the Contract Documents and ~~fails within a ten-day period~~ fails, after receipt of written notice from the ~~Owner~~ Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such ~~default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable~~ deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services ~~made necessary by such default, neglect, or failure. If current and future payments~~ and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the ~~Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.~~Owner within thirty (30) days of receipt of written notice from the Owner therefor.

§ 2.6 OWNER'S LACK OF LIABILITY TO THIRD PARTY

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

§ 2.7 OWNER'S RIGHT TO OCCUPY THE PROJECT

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

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

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

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

...

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or ~~Architect~~ architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public ~~authorities.~~authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

§ 3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work.

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

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

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§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor ~~determines that such~~ is then instructed to proceed with the required means, methods, techniques, sequences or procedures ~~may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.~~
without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

...

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

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

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

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§ 3.4.2 ~~Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.~~The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

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

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

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

Contract, for all costs associated with such requests.

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

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

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

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

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

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

...

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

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

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

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

...

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

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

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

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

The ~~Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.~~
Owner qualifies for exemption from State and Local Sales and Use Taxes pursuant to the provision of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act. Taxes normally levied on the purchase, rental and lease of materials, supplies and equipment used or consumed in performance of the Contract may be exempted by issuing to suppliers an exemption certificate in lieu of tax. Exemption certificates comply with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate issued in lieu of tax shall be subject to State Comptroller of Public Accounts Ruling No. 95-0.09, as amended. Failure by the Contractor or Subcontractors to take advantage of the Owner's exemption and to obtain such exemption certificate shall make him responsible for paying taxes incurred on materials furnished on the Project without additional cost to or reimbursement by the Owner.

...

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

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

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

.4 The Contractor shall pay all SWPPP related costs.

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§ 3.8.1 The Contractor shall include in the Contract Sum or GMP all allowances stated in the Contract ~~Documents.~~ documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may ~~direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.~~

direct and approve in writing. **§ ~~3.8.2~~** ~~Unless otherwise provided in the Contract Documents,~~

.1 ~~allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;~~

.2 ~~Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and~~

.3 ~~whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.~~

§ ~~3.8.3~~ ~~Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.~~

§ 3.9 Superintendent

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

~~Contractor.~~Contractor.**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

~~**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.~~

...

§ 3.10.1 ~~The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and~~ Within 30 days of being awarded an Amendment, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path clearly defined. The schedule shall not exceed time limits current under the Contract Documents. ~~The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.~~For further schedule requirements refer to specification section regarding project schedules in the Project Manual.

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§ 3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

...

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

...

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

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

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§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been ~~approved~~ accepted by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect

of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's ~~approval~~ acceptance thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's ~~approval~~ acceptance of a resubmission shall not apply to such revisions.

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

...

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

§ 3.12.12 The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

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

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§ 3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

...

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

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§ 3.18.1 ~~To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.~~**TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF EVERY TIER, EVEN IF THE BODILY INJURY, SICKNESS, DISEASE OR DEATH IS CAUSED BY OR ALLEGED TO HAVE BEEN CAUSED BY THE NEGLIGENCE, FAULT OR STRICT LIABILITY OF ANY OF THE INDEMNIFIED PARTIES.**

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

§ 3.18.2 ~~In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.~~It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall not be obligated under Subparagraph 3.18 to indemnify or hold harmless Architect or any agent, servant of employee of Architect from liability or damage that is caused by or results from:

- **.1** defects in plans, designs or specifications prepared, approved or used by the Architect; or
- **.2** negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:
  - **.1** personal injury or death;
  - **.2** property injury; or
  - **.3** any other expense that arises from personal injury, death or property injury.

§ 3.18.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the

indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

§ 3.20 PREVAILING WAGE RATES

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

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

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

§ 3.21 ANTITRUST VIOLATIONS

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

§ 3.22 THIRD-PARTY BENEFICIARY

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

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§ 4.2.2 The ~~Architect~~ Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of ~~construction, or as otherwise agreed with the Owner, to become generally familiar with~~ the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the work, and (3) to determine in general if the ~~Work observed~~ work is being performed in a manner indicating that the ~~Work,~~ work, when fully completed, will be in accordance with the Contract ~~Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for~~ documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract ~~Documents.~~Documents, except as provided in Section 3.3.1.

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§ 4.2.6 The Architect ~~has~~ shall have authority to reject Work that does not conform to the Contract Documents. The Architect shall be required to promptly notify the Owner of any non-conforming Work and shall reject such non-conforming Work unless the Owner objects to the rejection in writing within twenty-four (24) hours of such notification. Whenever the Architect considers it necessary or ~~advisable,~~ advisable for implementation of the intent of the Contract documents, the Architect will have authority to require inspection or testing of the Work in accordance with ~~Sections 13.4.2 and 13.4.3, whether or not the~~ the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Performance of any additional inspection or testing, which would result in additional cost to the Owner, shall require advance notice to and approval of the Owner. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the ~~Work.~~Work, except when the Contractor's inability to perform the Work is a result of design flaw, error or omission.

...

§ 4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure Authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

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~~**§ 4.2.13** The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.~~

...

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor. Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

...

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution. Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

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When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the ~~subcontract.~~subcontract, but only to the extent permitted by law.

...

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. ~~If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.~~

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§ 7.1.2 A Change Order shall be based ~~upon~~ on agreement among the Owner, Contractor, and ~~Architect.~~ Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents. A Construction Change Directive requires agreement by the Owner ~~and Architect~~ or the Owner's representative and Architect, and may or may not be agreed to by the ~~Contractor. An~~ Contractor; an order for a minor change ~~in the Work~~ may be issued by the Architect alone.

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§ 7.5 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

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

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

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

.1 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor or Sub-subcontractor's own forces, ten percent (10%) of the cost.

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

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

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

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

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

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

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4.

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

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

§ 7.5.5 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5.

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§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by ~~(1)~~ an act or neglect of the Owner or Architect, or of an employee of either, or of a ~~Separate Contractor; (2)~~ separate contractor employed by the Owner, or by changes ordered in the ~~Work; (3)~~ Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable ~~casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines,~~ casualties or other unforeseeable causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

...

§ 8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to Two Thousand Five Hundred Dollars ($2,500.00) per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for

Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. The liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadline for substantial completion and Contractor's achievement of substantial completion.

§ 8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, within ninety (90) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to Five Hundred Dollars ($500.00), per phase, for each and every Calendar Day beyond the 90-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial Completion is not achieved by the agreed contract completion date, the Project close-out period of ninety (90) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

§ 8.3.6 Extensions of time granted for causes described herein will be granted on the basis of 1.4 Calendar Days extension for each Regular Working Day lost.

§ 8.3.7 Each Bidder shall include in his proposed Contract Time an adequate allowance of inclement or adverse weather days. Contractor shall not be entitled to any extensions of the Contract Time adjustment to the Contract Sum due to inclement or adverse weather.

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

...

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

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

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

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

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

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

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

§ 9.3.1 ~~At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.~~No later than 3 working days prior to the first Wednesday of each month, submit an itemized Application for Payment, supported by such data sustaining the Contractor's right to payment as the Owner or Architect may require, and reflecting retainage, as provided elsewhere in the Construction Documents. Information on the form shall be divided into the same last day of the month preceding, which shall also be the basis of payment or as agreed by the Owner, Contractor and Architect by verification at the site, prior to submittal.

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

~~**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.~~

§ 9.3.2 ~~Unless otherwise provided in the Contract Documents, payments shall~~ Payments will be made on account of materials ~~and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and~~ or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

- **.1** The location must be agreed to, in writing, by the Owner and Surety.
- **.2** The location must be a bonded warehouse.
- **.3** Surety must agree, in writing, to each request for payment.
- **.4** The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Payments for materials or equipment stored on or off the site shall be conditioned upon ~~compliance by the Contractor with~~ submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials ~~and~~ or equipment or otherwise protect the Owner's interest, ~~and shall include the costs of applicable insurance, storage, and transportation to the site, for such~~ including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment. The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

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§ 9.3.4 The Contractor shall submit requests for payment in duplicate, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

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§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make ~~payment in the manner and~~

~~within the time provided in the Contract Documents, and shall so notify the Architect.~~progress payments in accordance with the following Section which shall be inserted as Article 5, Progress Payments, in the Owner-Contractor Agreement, AIA Document A101, 2017 Edition.

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

.2 Not later than twenty (20) working days following the first Wednesday of each month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner. Applications for Payment shall be submitted by the first Wednesday of the month.

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

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

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If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within ~~seven~~ ten days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within ~~seven~~ ten days after the date established in the Contract Documents, the amount certified by the ~~Architect or awarded by binding dispute resolution,~~ Architect, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

...

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Should the Architect determine that the Contractor's List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done.

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

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

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

be the sole judge of what constitutes a significantly large number of items.

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

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

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

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

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§ 9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor thirty-one (31) days after Substantial Completion of the Work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, and the Final Certificate for Payment has been issued by the Architect. The final payment will not be made until all of these conditions have been satisfied.

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§ 10.2.9 The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.

§ 10.2.10 The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous ~~materials or substances.~~ materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or ~~substance, including but not limited to asbestos or polychlorinated biphenyl (PCB),~~ substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and ~~notify the Owner and Architect of the~~

~~condition.~~report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in section 10.3.2.

...

~~§ 10.3.3~~ ~~To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.~~

~~§ 10.3.4~~ ~~The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.~~

~~§ 10.3.5~~ ~~The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.~~

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a ~~government~~ governmental agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall ~~reimburse the Contractor for all cost and expense thereby incurred.~~indemnify the Contractor for all costs and expenses thereby incurred, but only to the extent provided by law.

§ 10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

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§ 11.1 ~~Contractor's Insurance and Bonds~~**CONTRACTOR'S LIABILITY INSURANCE**

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

~~§ 11.1.1~~ ~~The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.~~

~~§ 11.1.2~~ ~~The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.~~

~~§ 11.1.3~~ ~~Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.~~

~~§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance.~~ ~~Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act~~

~~or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.~~

~~**§ 11.2 Owner's Insurance**~~

§ 11.2 The Owner requires the following minimum insurance coverages:

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

§ 11.2.1 The Owner shall ~~purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.~~
be named as an additional insured on a primary and non-contributory basis using form CG 2010 10 01 or similar endorsement providing equal or greater coverage in favor of the Owner.

Coverage shall include the following:

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

§ 11.2.2 ~~Failure to Purchase Required Property Insurance.~~ ~~If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~

Automobile Liability Combined Single Limit $1,000,000.00

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

§ 11.2.3 ~~Notice of Cancellation or Expiration of Owner's Required Property Insurance.~~ ~~Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any~~

~~property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.~~Workers' Compensation Statutory Limits

(a) Coverage at Statutory Limits with All States Endorsement

(b) Employer's Liability Each Accident $1,000,000.00
Disease (Policy Limit) $1,000,000.00
Disease (Each Employee) $1,000,000.00

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

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

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

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

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

§ 11.2.5 Additional Requirements for Architects, Engineers and Design Professionals (each a "Professional"):

(a) Professional Liability policy limits shall be one (1) times compensation amount due such Professional under the Contract, subject to a minimum limit of $1,000,000.00 and a maximum limit of $25,000,000.00.

(b) Professional Liability policies issued on a "claims made" basis must have a retroactive date shown on the certificate preceding date of contract. Such policies must include an Extended Reporting Period three years past completion of construction contract.

(c) Minimum coverage for excess (umbrella) insurance for Architects, Engineers and Design Professionals shall be one (1) times compensation amount due such Professional under the Contract, subject to a minimum limit of $1,000,000.00 and a maximum limit of $425,000,000.00. To the extent of Commercial General Liability coverage for the Professional exceeds $1,000,000.00, such amount may be used as a credit against the Excess (Umbrella) Insurance requirement set out in the preceding sentence.

§ 11.2.6 Insurance Limits for Consultants hired by a Professional

(a) Notwithstanding Section 11.1.2.1 above, Consultants shall have the following minimum insurance requirements:

(1) Worker's Compensation:	Statutory Limits	
Employer's Liability	Each Accident	$1,000,000.00
	Disease (Policy Limit)	$1,000,000.00
	Disease (Each Employee)	$1,000,000.00
(2) Commercial General Liability	General Aggregate	$1,000,000.00
	Products/Completed Operation Aggregate	$1,000,000.00
	Bodily Injury and Property Damage (each)	$1,000,000.00
	Personal and Advertising Injury	$1,000,000.00
(3) Automobile Liability	Per Person/Accident	$1,000,000.00
(4) Professional Liability	Program Limits,	$1,000,000.00

If applicable

Professional Liability policies issued on a "claims made" basis must have a retroactive date shown on the certificate preceding date of contract. Such policies must include an Extended Reporting Period three years past completion of Construction Contract.

§ 11.3 ~~Waivers of Subrogation~~The Owner requires that the following insurance requirements be satisfied:

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

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

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

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

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

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

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

.8 All insurance except Professional Liability must be issued on an occurrence basis.

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

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

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

~~**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.~~

~~**§ 11.3.2** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.~~

~~**§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance**~~

~~The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.~~

~~**§11.5 Adjustment and Settlement of Insured Loss**~~

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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

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

§ 11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

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

§ 11.5 WORKER'S COMPENSATION INSURANCE COVERAGE

§ 11.5.1 ~~A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.~~Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities

§ 11.5.2 ~~Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.~~**DEFINITIONS:**

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

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

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities

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

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

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

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

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

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

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

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

§ 11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

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

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

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

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

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

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

.1 A certificate of coverage, prior to the other person beginning work on the project, and

.2 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 10 days after the

person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project, and

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

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

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

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

§ 12.2.2.1 Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor. In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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~~If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.~~**§ 12.3.1** If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

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

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§ 13.7 EQUAL OPPORTUNITY

§ 13.7.1 The contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection

for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

§ 13.8 CRIMINAL BACKGROUND CHECKS

If applicable to the project site, the Contractor/Subcontractor shall certify compliance with Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117 related to criminal background checks for contractor and subcontractor employees or ensure compliance with the Owner's LEE Fast Pass Procedure for obtaining such criminal background check, as required by any Criminal History Certification provided by Owner .

§ 13.9 REQUIRED CERTIFICATIONS AND VERIFICATIONS

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law. Contractor further certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

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

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

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§ 14.1.3 If one of the reasons described in ~~Section 14.1.1 or 14.1.2~~ Section 14.4.1 or 14.4.2 exists, the Contractor may, upon seven ~~days'~~ day's written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work ~~executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.~~ executed as of the date of the notice, plus costs of demobilization.

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§ 14.4.3 In the case of such termination for the Owner's convenience, the ~~Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.~~Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

...

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, ~~payment of money, a change in the Contract Time,~~ adjustment or interpretation of contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the ~~Owner~~ Owner, Architect, and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. ~~This Section 15.1.1 does not~~ Nothing herein shall require the Owner to make or file a Claim in order to ~~impose liquidated damages in accordance with the Contract Documents.~~
assess liquidated damages provided for in the Contract Documents.

...

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. ~~The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.~~

...

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party ~~under this Section 15.1.3.1 shall~~ must be initiated within ~~21~~ ninety (90) days after occurrence of the event giving rise to such Claim or within ~~21~~ ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

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§ 15.1.6.2 ~~If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.~~Adverse weather conditions shall not be the basis for additional time or additions to the Contract Sum.

~~§ 15.1.7 Waiver of Claims for Consequential Damages~~

~~The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes~~

- ~~**.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and~~
- ~~**.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.~~

~~This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.~~

§ 15.2.1 Claims, excluding those ~~where the condition giving rise to the Claim is first discovered~~ alleging an error or omission by the Architect or those arising after expiration of the period for correction of the ~~Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5,~~ Work, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. ~~Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.~~If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

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

~~§ 15.2.6~~ ~~Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.~~

~~**§ 15.2.6.1** Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.~~

...

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

§ 15.3.1 ~~Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.~~

§ 15.3.2 The parties ~~shall endeavor~~ may mutually agree to resolve their ~~Claims~~ claims by mediation which, unless the parties mutually agree otherwise, shall be ~~administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution~~ in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of ~~filing,~~ filing unless stayed for a longer period ~~by~~ of agreement of the parties or court order.~~If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~

...

~~**§ 15.4.1** If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.~~

~~**§ 15.4.1.1** A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.~~

~~**§ 15.4.2** The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

~~**§ 15.4.3** The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

~~**§ 15.4.4.1** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to~~

~~be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).~~

~~**§ 15.4.4.2** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.~~

~~**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.~~

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:47:49 CT on 11/15/2024 under Order No. 3104238995 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

CLEAR CREEK
INDEPENDENT SCHOOL DISTRICT

Contractor and Consultant Badging

Policy and Procedures Manual

Facility Services

May 2014

TABLE OF CONTENTS

INTRODUCTION

The safety and security of the students, staff and parents of the Clear Creek Independent School District is of the utmost importance and we utilize all of the tools at our disposal to ensure a safe environment. In May 2007, the Texas legislature passed Senate Bill 9 to establish regulations to ensure that contractors and their employees that have the opportunity for direct, continuing and unsupervised contact with students have not been convicted of certain offenses.

Contractors and consultants are valued partners in creating safe and effective learning environments for our students and staff and our policies and procedures are designed to provide the most flexibility, while meeting the requirements and intent of Senate Bill 9. This Policy and Procedures Manual is provided to assist contractors and consultants in understanding the requirements established by Senate Bill 9 and Clear Creek Independent School District's policies and procedures as they relate to those requirements.

We are delighted to partner with you to create safe and effective learning environments for our students and ask that you read and understand these policies and procedures as they related to the badging process.

For additional information about the District's Contractor and Consultant badging requirements, policies and procedures please call 281-284-0047.

Sincerely,

Paul E. Miller
Director of Facility Services
Clear Creek Independent School District

PURPOSE

This document represents the establishment of comprehensive policies and procedures to facilitate the issuance of contractor and consultant identification badges for the Clear Creek Independent School District. The mission of the Facility Services Department is embodied in the following goals:

1. To ensure the safety and security of the students, staff and parents of the Clear Creek Independent School District (the "District").

2. To comply with the laws and regulations of the State of Texas and the policies of the District's Board of Trustees.

3. To protect the Districts facilities and assets.

4. To eliminate unnecessary delays in the completion of construction projects and the completion of contracted services for the District.

5. To maintain consistent and easy to understand procedures as they relate to contractor and consultant identification and access badges.

GOVERNING LAWS AND REGULATIONS

State Law

In 2007 the 80th Legislature of the State of Texas passed Senate Bill 9 (SB 9) and the bill was signed into law by Governor Perry on June 15, 2007. The law dramatically expanded requirements for the review of criminal history information for school district employees and contractors. The new law was codified into the Texas Education Code under Chapter 22 (School District Employees and Volunteers) and is extended to contractors and consultants (Section 22.0834 Subsection A) as well as their subcontractors (Section 22.0834 Subsection K).

Section 22.0834 applies to "a person who is not an applicant for or holder of a certificate under Subchapter B, Chapter 21, and who on or after January 1, 2008, is offered employment by an entity that contracts with a school district, open-enrollment charter school, or shared services arrangement to provide services, if:

1.) the employee or applicant has or will have continuing duties related to the contracted services; and
2.) the employee or applicant has or will have direct contact with students.

If employees of a contractor or consultant meet both of the two criteria described above, they are considered to be "*Covered Employees*" and are required to submit to one of the following based upon their date of employment:

Hired by Contractor or Consultant prior to January 1, 2008 – Contractor or Consultant must obtain state criminal histories (CHRI) as required in Section 22.0834(g).

Hired by Contractor or Consultant on or after January 1, 2008 – Contractor or Consultant must obtain national criminal histories (NCHRI) as required in Section 22.0834(a),(b).

If employees of a subcontractor meet both of the two criteria described above, they are considered to be "Covered Employees" and are required to submit to national criminal histories (NCHRI) as required in Section 22.0834(a),(b).

National Criminal History Records (NCHRI) – Criminal history records from the Texas Department of Public Safety (DPS) and the Federal Bureau of Investigations (FBI) retrieved through fingerprint identification information. The FBI's records include data from Texas and other states. This type of record is often referred to a "Fingerprint-based search".

State Criminal History Records (CHRI) – Information collected by DPS that consists of arrests, detentions, indictments and other formal criminal charges and their dispositions. These records include only data from Texas based on name and other identifiable information. This type of record is often referred to a "Name based search".

As required under Education Code Section 22.085, any employee of a contractor, consultant or subcontractor whose criminal history record includes any of the following convictions is considered ineligible to work at the District:

1.) A felony offense under Title 5, Texas Penal Code
2.) An offense on conviction of which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure
3.) An offense under the laws of another state or federal law that is equivalent to an offense as described in items 1 or 2 above ***and*** at the time the offense occurred, the victim of the offense was under 18 years of age or was enrolled in a public school.

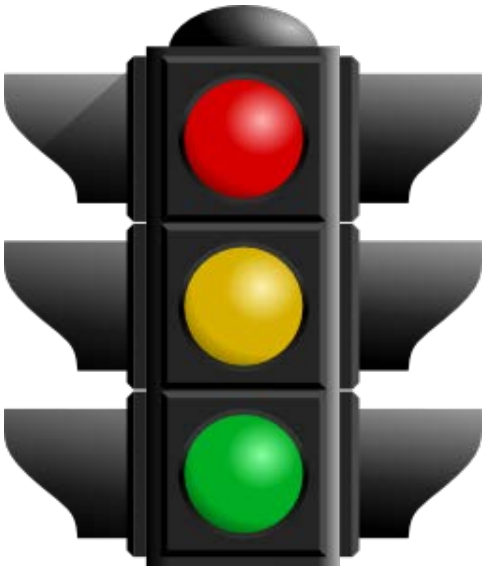
Exception: This section does not apply (the offenses do not preclude the employee from working for the District) if the offense occurred more than 30 years prior to the date of the NCHRI or if the employee has satisfied all of the terms of the court order entered upon conviction.

It is important to note that the law places the responsibility for obtaining and reviewing the criminal history records of its employees on the contractor, consultant or subcontractor. The District is authorized to review or verify the criminal history record, but it is not *required* to do so. The contractor, consultant or subcontractor is required to certify that it has satisfied the requirements of this section via an affidavit along with an applicable list of employees for whom it has received and reviewed the NCHRI and determined that the employees listed have not been convicted of one of the disqualifying offenses listed above. This process is described in further detail in the Badging Procedures Section beginning on Page 13.

DISTRICT POLICIES

The Clear Creek Independent School District has developed policies designed to provide the greatest flexibility possible while maintaining compliance with the requirements of Senate Bill 9 (SB9).

The District has established three distinct categories of identification and access badges for use by contractors, consultants and subcontractors.



A "***Red Badge***" is provided to employees based upon an employee listing with no background check or affidavit of any kind

A "***Yellow Badge***" is issued to employees based upon a "name based" DPS background check

A "***Green Badge***" is issued employees based upon a "fingerprint based" DPS background check

Red Badge

The "Red Badge" classification is provided for contractor, consultant and subcontractor employees that *will* *not* have substantial opportunity for continuing, direct and unsupervised contact with students. There are specific restrictions on the availability of this type of badge including the following:

- Contract work completed on an *unoccupied* ("green field") site or at a campus that has been closed for the summer (applicable only to Intermediate and Elementary campuses as approved by the District) – Contractors and subcontractors (not consultants) can utilize red badges at these sites until substantial completion. At or near substantial completion, contractor and subcontractor employees will be required to obtain green badges for punch list or warranty work as they will then have substantial opportunity for continuing, direct and unsupervised contact with students. If contractor or subcontractor employees need to access the campus prior the end of school, a green badge and close coordination with District project managers will be required.

- Contract work completed on an *occupied* campus – Contractors and subcontractors (not consultants) can utilize red badges at these sites until substantial completion and under strictly controlled circumstances. To qualify for a red badge at an occupied school campus, the contractor is required to follow the following protocols:
    1. Establish a secure work area by installing physical and visual barriers between the work area and the remainder of the campus. These barriers must be substantial enough to ensure that they are not easily defeated by curious students or contractor and subcontractor employees. These barriers must be maintained for the duration of the project or until substantial completion when green badges are required.
    2. Provide and maintain sanitation facilities (portable restrooms) within the secure area for the duration of the project.
    3. Establish and enforce a policy prohibiting employees with red badges from performing work outside of the secure work area.

Red badges are issued with no background check, so it is critical that jobsite supervisors remain vigilant to ensure that unauthorized contact with students and staff does not occur. In certain circumstances, the District will provide on-site security to patrol the perimeter of the secure area to monitor compliance.


Yellow Badge

The "Yellow Badge" classification is provided for contractor and subcontractor employees who will be working on a project with a duration of two weeks or less. The badge is issued based upon a CHRI (name-based background check) using the criteria discussed on Page 6. Contractor and subcontractor employees with yellow badges are allowed access to occupied campuses, however they are required to coordinate closely with District project managers.


Green Badge

The "Green Badge" classification is provided for contractor, consultant and subcontractor employees who have completed a NCHRI (fingerprint-based background check) using the criteria discussed on Page 6. Contractor, consultant and subcontractor employees with green badges are allowed unrestricted access to any district facility provided that they coordinate with District project managers. Because consultants work on numerous projects throughout the district and a various times, their employees are required to obtain green badges to access District sites.

CONTRACTOR RESPONSIBILITIES

Senate Bill 9 applies to an entity that contracts directly with school districts to provide *services*. Texas Education Code § 22.0834(a). A *service contractor* is an entity, including a governmental entity, which "contracts or agrees with a school district by written agreement or verbal understanding, to provide services through individuals who receive compensation. 19 Texas Administrative Code § 153.1101(10).

A Contractor has six general responsibilities:

1. For covered employees, obtain state or national criminal history records, as required by statute.
    a. Employed prior to January 1, 2008 – CHRI
    b. Employed on or after January 1, 2008 - NCHRI
2. Certify compliance to the District.
    a. Contractor must certify to the District it has received and reviewed the criminal history record for all covered employees providing the contracted service.
    b. Return to the District a notarized Affidavit of Certification of Criminal History Record Information Reviewed by Contractor-Employee and Schedule A and/or B provided by the District.
3. Obtain certification of compliance from all subcontractors.
    a. A contractor must require that any subcontractor obtain criminal history record information on their covered employees.
    b. A contractors complies with the legal requirements if the contractor obtains written certification from each subcontractor.
    c. Subcontractor must return a notarized Affidavit of Certification of Criminal History Record Information Reviewed by Contractor Employee and Schedule B (only) to the Contractor.
    d. Contractor must forward Certification of Subcontractor compliance to District.
4. Upon request, provide identifying information on covered employees to the District.
    a. Districts are permitted to run their own criminal history checks on contractor employees. The District will need identifying information on each of the employees. Texas Education Agency regulation require contractors to provide information on their employees upon request from the District. 19 Texas Administrative Code § 153.117(c)(4).

5. For subcontractor employees who are not covered, maintain any conditions or precautions required by District.
    a. Request approval from District for Red Badge
    b. Establish secure work area
    c. Provide Sanitation facilities
    d. Establish and enforce policies prohibiting work outside the secure area to prevent student contact.
6. Prohibit employees with disqualifying convictions from serving in the District.

Contractors/Consultants are only eligible for GREEN Badges on CCISD projects.

SUBCONTRACTOR RESPONSIBILITIES

In 2009, the legislature amended the law to require that subcontractors also obtain criminal history record information on covered employees. A *subcontractor* is an entity that contracts with an entity that is not a school district to provide services to a school district. Texas Education Code § 22.0834. The law extends the contractor requirement to subcontractors. Subcontractors must obtain state or national criminal history records, depending on date of employment, on all covered employees.

A Subcontractor has five general responsibilities:

1. For covered employees, obtain national criminal history records, as required by statute. For subcontractor's, the date of employment is the **later of**:
    a. The date the subcontractor secured the services of the employee; or
    b. The date the contractor secured the services of the subcontractor
        i. The date of *securing the services* is the date the employee or subcontractor accepts an offer from the service contractor for a specific job position or specific District project.
2. Certify compliance to the Contractor.
    a. A contractor must require that any subcontractor obtain criminal history record information on their covered employees.
    b. A contractors complies with the legal requirements if the contractor obtains written certification from each subcontractor.
    c. Subcontractor must return a notarized Affidavit of Certification of Criminal History Record Information Reviewed by Contractor Employee and Schedule B (only) to the Contractor.
    d. Contractor must forward Certification of Subcontractor compliance to District.
3. Obtain certification of compliance from all second tier subcontractors.
    a. The subcontractor must obtain similar written certifications from each of its subcontractors.
4. Upon request, provide identifying information on covered employees to the District.
    a. Districts are permitted to run their own criminal history checks on contractor employees. The District will need identifying information on each of the employees. Texas Education Agency regulation require contractors to provide information on their employees upon request from the District. 19 Texas Administrative Code § 153.117(c)(4).

5. Prohibit employees with disqualifying convictions from serving in the District.

Subcontractors are employees of the General Contractor, not Clear Creek ISD. All affidavits and/or applications must be sent via the General Contractor. Affidavits and/or applications for badges are project specific. If a subcontractor is employed by more than one General Contractor, they will be required to provide all necessary documents to each General Contractor.

Subcontractors may be eligible for GREEN, YELLOW or RED badges on CCISD projects.

BADGING PROCEDURES

GREEN Badge

Clear Creek Independent School District shall ensure that each of its Contractors certify that they have obtained all criminal history information for covered employees. Contractors, Consultants and Subcontractors must take the following steps in order to comply with SB9:

1. Establish an account on the DPS FACT Clearinghouse:
    a. Contact the DPS Access and Dissemination Bureau and advise them that you are applying for access as a school contractor:

        Access and Dissemination Bureau
        Texas Department of Public Safety
        Crime Records Service
        P.O. Box 149322
        Austin, TX 78714-9322
        Email: FACT@txdps.state.tx.us
        Phone: 512-424-2365

    b. Access and Dissemination Bureau will provide via email:
        i. The website address to sign up for access to the DPS Secure Website for criminal history (FACT is a component of that site)
            1. Sign the Secure User Site Agreement and return to the DPS. You may fax the signed copies to the Access and Dissemination Bureau and mail the originals within 10 days.
        ii. A user agreement for FACT
            1. Sign the FACT User agreement and return to DPS. You may fax the signed copies to the Access and Dissemination Bureau and mail the originals within 14 days.
        iii. The Security Policy for Non-Criminal Justice Agency Access, Use and Dissemination of Criminal History Record Information.
        iv. A request for the front page and signature page of the contract with the District, or if a contract is not yet available, a letter on District letterhead stating the intent of contract.
        v. Fax documents to Access and Dissemination Bureau and mail the originals.

After the User Agreements are received, DPS will notify the contractor of their approval and provide them with a "Service Code Form" along with the company's User Number for use on the FACT. The form will be sent to the contractors' Message Center on the Secure Website. That form must be given to each covered employee. The employees will use the Service Code Form when scheduling their fingerprinting. The information in the DPS FACT Clearinghouse is confidential and access must be restricted to the least number of persons needed to review the records. The account must include at least one designated supervisor to make necessary changes and to monitor the sites security and access to the criminal history data retrieved. Additional users must be limited to those who need to request, retrieve, or evaluate data regarding the employee.

2. Perform criminal history background searches on covered employees. An employee is considered ineligible for any of the following:
   a. Conviction of a Title 5 felony against a minor or student – murder, attempted murder, assault, sexual assault and similar offenses.
   b. Person is required to register as a sex offender due to an offense against a minor or student.
   c. Conviction of similar offense under federal law or the laws of another state.
3. Unsubscribe to records of employees who leave your employment.
4. Respond to subscription notices of updates to criminal history record information.
   d. Contractor will immediately remove covered employee from contract duties and notify the District in writing within 3 business days
5. Maintain security and confidentiality of criminal history record information obtained from FACT.
6. Compile and maintain a current list of all necessary identifiable information for covered employees to be submitted to the District, upon request.
7. Certify compliance to the District by submitting a notarized affidavit of **Certification of Criminal History Record Information Reviewed by Contractor Employer** and **Schedules A and/or B** per project via email to Andrea Torres at Atorres@ccisd.net.
   e. **Schedule A** – for use by contractors and consultants affirming covered employees hired before January 1, 2008 have not been convicted of any offense identified in Section 22.085 of the Texas Education Code.
      i. Employee Name – Legal name as it appears on ID
      ii. Date of Birth – Date of birth as it appears on ID

iii. Identifying ID Type – Identification type provided, i.e. Texas Drivers Licenses, Passport, etc. This information must be provided and will be verified at badging appointment.
iv. Identifying ID Number – Number listed on the ID type. This information must be provided and will be verified at badging appointment.

f. **Schedule B** – for use by contractors, consultants and all subcontractors affirming that covered employees hired after January 1, 2008 who have not been convicted of any offenses identified in Section 22.085 of the Texas Education Code.
   i. Employee Name – Legal name as it appears on ID
   ii. Date of Birth – Date of birth as it appears on ID
   iii. Identifying ID Type – Identification type provided at FAST Pass Appointment, i.e State issuing License, Passport, VISA, etc. This information must be provided and will be verified at badging appointment.
   iv. Identifying ID Number – Number listed on the ID Type. This information must be provided and will be verified at badging appointment.

Upon receipt of the Affidavit and corresponding Schedule A and/or B from the General Contractor, the District will review information and assert compliance with SB 9 requirements. Contractor will be notified of badging eligibility, ineligibility or District will request additional information.

YELLOW Badge

Clear Creek ISD will ensure that contractor and subcontractor employees who will be working on a District project with at duration of two weeks or less undergo a CHRI check. Yellow Badge requests must be approved by the CCISD Project Manager.

1. Request Short-Term Contractor Badge Application from CCISD Facility Services Badging Office.
   a. Full Name – Legal name as it appears on ID
   b. Date of Birth – date of birth as it appears on ID
   c. Texas Driver's Licenses Number – number as it appears on ID
   d. Phone – Applicants primary phone number
   e. Email

f. Employer – Contractor or Subcontractor name
g. CCISD Project – name of District project
h. Length of Project – anticipated time to complete project
i. Disclaimer – permission to conduct a criminal background check
j. Signature – acknowledgement of disclaimer

2. Completed form and legible copy of Identification (referenced on application) forwarded to Andrea Torres at Atorres@ccisd.net.

Upon receipt of the Short-Term Contractor Badge Application from the General Contractor, the District will perform a name-based criminal background check through the Texas DPS. Contractor will be notified of badging eligibility or District will request additional information.

RED Badge

Under strictly controlled circumstances, Clear Creek ISD will issue Red badges to subcontractor employees who will be working on a District projects. Approval by the District must be received prior to Red Badge application due to the specific restrictions on the availability of this type of badge.

1. Request Red Badge Application form from the CCISD Facility Services Badging Office.
    a. Employee Name – Legal name as it appears on ID
    b. Identifying ID – Identification type provided and ID number, i.e. Texas Drivers Licenses, Passport, etc.
    c. Identifying ID Number – Number listed on the ID type. This information must be provided and will be verified at badging appointment.
2. Completed form to be forwarded to Andrea Torres at Atorres@ccisd.net.

Upon receipt of the Red Badge Application from the General Contractor, the District will notify the Contractor of badging eligibility or District will request additional information.

BADGING APPOINTMENTS

Prior to scheduling a badging appointment, the Facility Services Department will review the information submitted. Clear Creek ISD will verify the validity of the employees listed on Schedule B through the DPS FACT Clearinghouse. Employee(s) listed on Schedule B not found in the DPS FACT Clearinghouse will not be eligible to schedule an appointment. Yellow Badge applications require review of the Criminal History record by Clear Creek ISD through the DPS. To avoid delays, all applications, affidavits and schedules must be complete. Please allow one business day to process badge requests. Once verified, the Facility Services Department will send an email to the contractor specifying the employee(s) eligible to schedule a badging appointment.

Badging appointments are scheduled on Mondays, Wednesdays and Fridays (excluding summer months) during business hours. When scheduling an appointment, please be prepared to provide the company name, employee name(s) and a contact number. Employees must bring a photo ID to their appointment; this must be the identification card listed on the Affidavit or application. To cancel or re-schedule an appointment, please call 281-284-0065.

CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION REVIEW BY CONTRACTOR-EMPLOYER

Certifying Affidavit submitted to:

Name of School District: **Clear Creek Independent School District**

Mailing Address: **2145 W. Nasa Blvd**
Webster, Texas 77598

Project: _____

_____

STATE OF TEXAS §

COUNTY OF _____ §

(1) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to **Clear Creek Independent School District** (the "District") that such firm has obtained, reviewed and verified, from a law enforcement or criminal justice agency, the criminal history record information of all employees hired *before January 1, 2008,* who (a) have or will have continuing duties related to the contracted services, and (b) have or will have direct contact with students. Such employees are identified by name on Schedule A attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule A have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(2) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to the District, that such firm has obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse , the national criminal history record information of all employees hired ***on or after January 1, 2008***, who (a) have or will have continuing duties related to the contracted services, and (b) have or will have direct contact with students. Such employees are identified by name on Schedule B attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule B have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(3) The undersigned firm swears and covenants that no present or future employee will provide services to the Project that involve direct contact with students unless and until such employee's national criminal history record information has been reviewed and cleared as required by Paragraph (2) above, and an updated Certification has submitted by the contractingng firm to the District with an updated Schedule B identifying such employees. In the event of an emergency, an employee who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District representative.

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

(5) Furthermore, if requested by the District, the name, driver's license number, and any other information required by the DPS will be submitted to the District for any person on either Schedule A or Schedule B.

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

_____

SUBSCRIBED AND SWORN TO BEFORE ME this_____ day of _____, _____.

Notary Public _____ State of _____

My Commission expires _____

CLEAR CREEK
INDEPENDENT SCHOOL DISTRICT

Schedule A

Hire Date Prior to January 1, 2008

(General Contractors and Consultants Only)

Employee Name	Date of Birth	Identifying ID Type*	ID Number

*Identifying ID can be Texas Driver's Licenses, State Issued Identification Card, Passport, etc.

CLEAR CREEK
INDEPENDENT SCHOOL DISTRICT

Schedule B

Hire Date On or After January 1, 2008

(General Contractors, Consultants and Sub-Contractors)

Employee Name	Date of Birth	Identifying ID Type*	ID Number

*Identifying ID can be Texas Driver's Licenses, State Issued Identification Card, Passport, etc.

RED Badge

For use on "Unoccupied" Campus or "Occupied" Campuses with Security Provisions

(Subcontractors Only)

Company Name _____ Project Name _____

Employee Name	Date of Birth	Identifying ID Type	ID Number

*Identifying ID can be Texas Driver's Licenses, State Issued Identification Card, Passport, etc.

Short-term Contractor Badge Application

(Yellow Badge – Project 2 weeks or less)

In accordance with Texas Education Code Sections 22.083-22.084, Texas school districts may obtain from any law enforcement or criminal justice agency all criminal history record information on applicants for employment or other applicants for Contractor/Professional Services.

This application is intended to authorize Clear Creek I.S.D. to obtain a Texas Department of Public Safety Criminal History Record for the following individual at the cost of $1.00 per individual.

Full Name: _____

Date of Birth: _____

Texas Driver's License Number: _____

Phone: _____

Email: _____

Employer: _____

CCISD Project Name/Location: _____

Length of Project: _____

Disclaimer

☐ I understand by submitting this contractor application that I give CCISD permission to conduct a criminal background check (CBC) in accordance with CCISD's Safe and Secure School policy.

Applicant's Signature _____

Date _____

The following Witness signature has confirmed the identity through TDL verification and witnessed approval to complete the DPS background check.

Witness/CCISD Employee Signature _____

Date _____

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future Work.
7. Purchase contracts.
8. Owner furnished products.
9. Owner furnished, Contractor installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.
14. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: Multi Campus Priority Repairs for Falcon Pass, Goforth, and Robinson
1. Project Locations: Falcon Pass ES; 2465 Falcon Pass; Houston, Texas 77062
Goforth ES; 2610 Webster St; League City, Texas 77573
Robinson ES; 451 Kirby Rd; Seabrook, Texas 77586.

B. Owner:
1. Owner's Representative: Alex Aragon, Director of Facility Services.

C. Architect: VLK Architects, Inc., Houston, Texas.

D. Consultants: Additional design professionals have been retained who have prepared designated portions of the Contract Documents.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

Interior Renovations

1.5 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

A. Cooperate fully with Owner so Work may be carried out smoothly, without interfering with or delaying the work or work by Owner. Coordinate the Work with Work performed by Owner.

B. The Owner reserves the right to let separate contract for Work outside of the scope of this Contract. Cooperate fully with separate contractors so Work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with Work performed under separate contracts.

C. Purchase Contracts: The Owner reserves the right to negotiate purchase contracts with suppliers of material and equipment that may be incorporated into the Work. The Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
   1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

D. Owner Furnished, Contractor Installed Products (OFCI): The Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections when applicable.
   1. Owner Furnished Products: Coordinate with Owner.

1.6 SEQUENCING

A. Mechanical Scope of Work: At any campus and at any area where interiors work is included in the work of this Contract, then the work of dual duct box replacement shall not commence in that area until the interiors work in that area is complete. New interiors work shall not be installed in any area of the building that is without air conditioning due to the work of dual duct replacement.

B. Flooring: At all campuses removal of existing flooring and installation of new flooring in the Gymnasiums and Cafeterias shall be commenced not earlier than March 15, 2025, and shall be fully completed and ready for its intended use by the Owner not later than March 23, 2025.

C. Replacement of Operable Partitions: At all campuses where replacement of operable partitions is in the base bid scope of work or where replacement of operable partitions is included as an Alternate, the removal of said operable partitions shall commence not earlier than March 15, 2025, and shall be fully completed and ready for its intended use by the Owner not later than March 23, 2025.

1.7 ACCESS TO SITE

A. Use of Site: Limit use of Project site to Work in areas and areas within the Contract limits indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
   1. Limits: The drawings indicate the limits of the construction operations.
   2. Driveways, Walkways, and Entrances: Keep driveways. parking areas, student drop off and pick up points, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the students, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in weathertight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform Work to prevent interference with Owner's day to day operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
   2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
   3. Before limited Owner occupancy, ensure mechanical and electrical systems are fully operational, and required tests and inspections and start up procedures are successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
   4. Upon occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.9 WORK RESTRICTIONS

A. Work Restrictions: Comply with restrictions on construction operations. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction. Extent of work and utility interruption shall be coordinated with Owner in advance. On dates designated as assessment testing dates, work within existing buildings is not allowed and work in other areas may be restricted to eliminate testing disruption. Work on these dates must be coordinated with the Owner in advance and no additional contract time will be allowed for such dates.

B. On Site Work Hours: Limit Work to normal working hours, Monday through Friday, unless otherwise indicated. Comply with local ordinances with respect to work hours and days. Coordinate with Owner when it is necessary to extend working hours or Work on weekends.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and after providing temporary utility services according to requirements indicated:
   1. Notify Owner not less than two weeks in advance of proposed utility interruptions.
   2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner not less than two weeks in advance of proposed disruptive operations.
   2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Controlled Substances, Firearms, and Explosive Devices: Use of tobacco products, controlled substances, firearms, and explosive devices on the site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of each specification section.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 CONSTRUCTION SCHEDULE

A. The Owner has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete by:
   August 1, 2025

B. There will be No Extensions of Time due to weather.

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include
   1. Lump sum allowances.
   2. Unit cost allowances.
   3. Quantity allowances.
   4. Contingency allowances.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.4 LUMP SUM, UNIT COST, AND QUANTITY ALLOWANCES

A. Use the lump sum, unit cost, and quantity allowances only as directed by Architect for Owner’s purposes and only by executed Change Proposal Requests and Allowance Expenditure Authorizations that indicate amounts to be charged to the allowance.

B. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight and delivery to site.

C. Unless otherwise indicated, Contractor's costs for receiving and handling at site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

D. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

E. If requested by Architect and Owner, transfer unused amounts remaining in lump sum, unit cost, and quantity allowances to the Owners Contingency Allowance. Otherwise, credit unused amounts remaining in the lump sum, unit cost, and quantity allowances to Owner by Change Order.

1.5 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by executed Change Proposal Requests and Allowance Expenditure Authorizations that indicate amounts to be charged to the allowance.

B. Contractor's related costs for work ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation**,** equipment rental, and similar costs directly attributable to the work completed under the allowance. Contractor general conditions, profit and overhead shall be included as part of the Contract Sum and not part of the allowance.

C. Change Proposal Requests and Allowance Expenditure Authorizations authorizing use of funds from the contingency allowance will include Contractor's related costs. Contractor general conditions, overhead and profit on Contingency Allowances shall be included as part of the Contract Sum and not part of the allowance.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.6 ADJUSTMENT OF ALLOWANCES

A. Allowances will be adjusted by an executed Allowance Expenditure Authorization based upon executed Change Proposal Requests. Work to be completed under allowances may proceed after an Owner executed Change Proposal Request has been received by the Contractor. Work funded by allowances may be included on an application for payment only after an Owner executed Allowance Expenditure Authorization has been received by the Contractor.

B. Upon receipt of an Owner executed Allowance Expenditure Authorization, transfer unused lump sum, unit cost and quantity allowance funds to the Owners contingency allowance. Upon receipt of an Owner executed Allowance Expenditure Authorization, transfer all other unused allowance amounts to the Owners contingency allowance.

C. At Project closeout, credit unused amounts remaining in Owners contingency allowance to Owner by Change Order.

D. Change Orders to increase or add allowances to the project will include Contractor’s reasonable costs including delivery, installation, equipment rental and other related costs. Reasonable Contractor general conditions costs, reasonable Contractor profit and overhead (in accordance with Section CB) will be included in the Change Order.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related Work.

B. All work completed under allowances shall be executed in accordance with the requirements of the Contract documents.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1 Owners Contingency: $155,000

1. Contractor shall include the amount indicated in the Base Proposal as a contingency to cover the cost of hidden, concealed, or otherwise unforeseen conditions and for other costs as directed by the Owner which develop during completion of the work. Contractor shall be allowed to recover costs associated with the completion of work under the contingency; Contractor general conditions, overhead and profit should be included in the Base Proposal and is not part of the allowance.

END OF SECTION 01 21 00

SECTION 01 23 00 - ALTERNATES

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 sixty (60) 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 includes 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

A1 Alternate No. 1: State in the proposal form the amount to add to or deduct from the Base Proposal for the Proposed Team. This alternate is intended to provide the Contractor the opportunity to adjust the Base Proposal up or down based upon the proposed subcontractors submitted along with Alternate proposals.

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A2 Alternate No. 2: State in the proposal form the amount to deduct from the Base Proposal if the same General Contractor is selected for both CCISD Priority Repairs projects. Each project will require a separate general contracting team and separate installers for carpet and vinyl for each project.

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A3 Alternate No. 3 (Falcon Pass, Goforth, Robinson): State in the proposal form the amount to add to or deduct from the base proposal for porcelain tile wainscot throughout the main corridor as shown by drawings and as specified. Remove and reinstall all fixed equipment and furniture at partitions scheduled to receive installation of wainscot. If wainscot is accepted, then corner guards are to be omitted from scope of work

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A4 Alternate No. 4 (Falcon Pass, Goforth, Robinson): State in the proposal form the amount to add to or deduct from the base proposal for porcelain tile wainscot at the front entrance and library entry as shown by drawings and as specified. Remove and reinstall all fixed equipment and furniture at partitions scheduled to receive installation of wainscot. Remove wood chair railing edging. Remove and reinstall shelving if needed. If wainscot is accepted then corner guards are to be omitted from the scope of work

_____DOLLARS

(ADD or DEDUCT $_____)

Proposers shall cross-out term that does not apply.

A5. Alternate No. 5 (Robinson): State in the proposal form the amount to be added to the base proposal for vinyl wall covering as shown by drawings and as specified. Tape and float existing demountable partition. Install vinyl wall covering throughout. Remove and reinstall all room signage if vinyl wallcovering is being Installed.

_____DOLLARS

(ADD $_____)

A6. Alternate No. 6 (Falcon Pass, Goforth, Robinson): State in the proposal for the amount to add to the base proposal to replace existing Vent-A-Kiln system at each campus like for like. Scope of work to be limited to the equipment, ductwork reconnection, power reconnection, and any ceiling or wall repairs from the replacement of the system

_____DOLLARS

(ADD $_____)

A7. Alternate No. 7 (Falcon Pass, Goforth, Robinson): State in the proposal form the amount to add to the base proposal to repaint throughout the building as shown by drawings and as specified, including handrails and exposed structure.

_____DOLLARS

(ADD $_____)

A8. Alternate No. 8 (Goforth): State in the proposal form the amount to add to the base proposal to replace the existing partition with manual folding partition.

_____DOLLARS

(ADD $_____)

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

B. Products: Items purchased for incorporation in the Work, regardless if specifically purchased for the project or taken from the Contractor's previously purchased stock. The term *product* is inclusive for "*material*, *equipment*, *assembly*, *system*" and other terms of similar intent.

1.4 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use facsimile of form provided in Project Manual.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, which are necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.

i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected Work as necessary to integrate Work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 30 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received prior to the Award of the Contract. Requests received after that time may be considered or rejected at discretion of Architect.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's construction schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.
      g. Requested substitution is compatible with other portions of the Work.
      h. Requested substitution has been coordinated with other portions of the Work.
      i. Requested substitution provides specified warranty.
      j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION

Not Used

END OF SECTION 01 25 00

REQUEST FOR SUBSTITUTION

Contract Award Date: _____

To: _____

Substitution Requested By: _____

Project Name and Number: _____

We submit for consideration the following product in lieu of the specified item for the above project:

Drawing No.	Specification Section	Paragraph	Specified Item
_____	_____	_____	_____

Proposed Substitution: _____

Request is made during ____ bidding _____ construction period.

Submit in accordance with Section 01 33 00.

1. Technical data, cost, and time information relating to changes to Construction Documents required by proposed substitution.
2. Detailed comparison of proposed substitution and specified product including but not limited to warranty, significant variations, qualifications of manufacturers, and maintenance.
3. Complete technical data, detailed shop drawings, samples, installation procedures, warranty, and substantiating data marked to indicate equivalent quality and performance to that specified. Manufacturer sell sheets are not acceptable submittals.

Cause for Request: _____

Cost saving realized by Owner _____

Does substitution affect adjacent Work, Construction Documents, cost, schedule, quality, and related submittals?

Yes _____ No ____ On separate sheet, explain affects to the Work, documents, schedule, and submittals.

The Contractor is responsible for associated costs and additional time of the proposed substitution including costs incurred by the Architect for evaluation of substitution and changes to the documents. Describe costs for changes to design, including engineering and detailing costs caused by the requested substitution.

_____

_____

Warranty: Is the warranty for the requested substitution the same or different? Same _____ Different _____

Explain Differences: _____

Contractor Certification:

In making a request for substitution, the Contractor certifies that:

1. The proposed substitution has been thoroughly researched and evaluated and determined as equivalent or superior to specified product or material, will fit into space provided, and is compatible with adjacent materials.

2. It will provide the same or better warranty for the proposed substitution at no additional cost to the Owner.
3. Cost data is complete and includes related costs under the Contract. Claims for additional costs related to the proposed substitution that may subsequently become apparent are waived.
4. It will assume the responsibility for delays and costs caused by the proposed substitution, if approved, are accepted by the Contractor unless delays are and costs are specifically mentioned and approved in writing by the Owner and the Architect.
5. It will assume the liability for the performance of the substitution and its performance.
6. The installation of the proposed substitution is coordinated with the Work and with changes required for the Work.
7. It will reimburse the Owner and Architect for evaluation and redesign services associated with the substitution request and, when required, by approval by authorities having jurisdiction.

Submitted by:

_____

Signature of Contractor Title

_____

Firm Telephone Date

Signature shall be by the individual authorized to legally bind the Contractor to the above terms. Failure to provide legally binding signature will result in retraction of approval.

FOR USE BY ARCHITECT:

____ Accepted ____ Accepted as Noted
____ Not Accepted ____ Received Too Late

By: _____

Date:_____

Remarks: _____

FOR USE BY OWNER:

____ Accepted ____ Not Accepted

By: _____

Date:_____

Remarks: _____

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling and processing Contract modifications.

B. Related Work:
   1. Section 01 25 00 - Substitution Procedures.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 *Architect's Supplemental Instructions*.

1.4 PROPOSAL REQUESTS

A. Owner Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop Work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request after receipt of Proposal Request, submit quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include statement outlining reasons for the change and the effect of the change on the Work. Provide complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use AIA Document G709.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: When an allowance is specified, refer to Section 01 21 00 for administrative procedures for preparation of Change Proposal Requests and Allowance Expenditure Authorizations for adjusting the Contract Sum to reflect actual costs of allowances.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Change Order Request, Architect will execute a Change Order also requiring signatures of Owner and Contractor on AIA Document G701 in accordance with the Supplementary Conditions to the Contract for Construction.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order or Change Proposal Request.
   1. Construction Change Directive contains a complete description of change in the Work and designates the method to determine the change in the Contract Sum, the charge to Allowances or any change in the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of Work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

B. Pencil Copy: A preliminary review copy of the application for payment for review by Architect and Owner prior to submission of final copy.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Updated Submittal schedule.
      c. Items required to be indicated as separate activities in updated Contractor's construction schedule.

   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment. Contractor's standard form or electronic media printout will be considered but must be approved by the Owner.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section and other items required in Section 01 29 73 Schedule of Values.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.

   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.

g. Allowance Expenditure Authorizations (numbers) with Change Proposal Request numbers and amounts.
h. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
    1) Labor.
    2) Materials.
    3) Equipment rentals.
    4) General Conditions.
        a. Supervisor.
        b. Submittals.
        c. Close-out.
        d. Field Engineering.
        e. Correction of deficiencies identified by Commissioning Agent and Test, Adjust and Balance consultants.
        e. Daily Clean-up.
        f. Final Clean-up.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on site and items stored off site. Include evidence of bonding and insurance in accordance with the Contract Documents.
6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line item value of unit cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of subcontractor general overhead and profit for each item. Contractor general conditions, profit and overhead shall not be allocated to subcontractor values.
    a. Temporary facilities and other major cost items that are not direct cost of actual Work in place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Submit preliminary (pencil) copy of proposed values to Architect or Architects field representative and Owner for review by 20th of month. Allow 96 hours for comments.

B. Once preliminary (pencil) approved, submit electronic copy of notarized originals of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702 or other similar form approved by the Owner.

C. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

D. Submit updated construction or recovery schedule that assures that the project completion schedule is met with each Application for Payment

E. Payment Period: Submit at intervals stipulated in the Agreement in accordance with Document 00 70 CB, Supplementary Conditions of the Contract.

F. Only materials stored on the project site shall be paid for unless the materials are stored in a bonded warehouse.

G. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Items which may be requested by the Architect or Owner to substantiate costs include, but are not limited to the following:
   1. Current Record Documents as specified in Section 01 77 00, Closeout Procedures maintained.
   2. Labor time sheets, purchase orders, or similar documentation.
   3. Affidavits attesting to off-site stored products.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01 29 00

SECTION 01 29 73 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract and Division 01 Specifications, as applicable, apply to this Section.

1.1 DESCRIPTION

A. Work Included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.

B. Coordinate requirements of this Section with the requirements of the General and Supplementary Conditions of the Contract concerning Schedule of Values.

1.2 QUALITY ASSURANCE

A. Use required means to assure arithmetical accuracy of the sums described.

B. When so required by the Owner, provide copies of the subcontracts or other data acceptable to the Owner, substantiating the sums described.

1.3 SUBMITTALS

A. Prior to the first Application for Payment, submit a proposed schedule of values to the Owner, as outlined below:
   1. Meet with the Owner and determine additional data, if any, required to be submitted.
   2. Secure the Owner's approval of the schedule of values prior to submitting first Application for Payment.

1.4 SCHEDULE OF VALUES

A. The Schedule of Values shall be broken down into item costs for each specification section as a minimum. After review by the Owner, the Schedule of Values shall be broken down into further items as required. (See following list and refer to the enclosed sample.). In addition, total each Specification Division separately. All values provided on the schedule of values shall be based upon subcontractor costs and/or the reasonable value of each element of work, subject to owner approval. Architect shall have final authority in determining the reasonable value of each element of work listed on the schedule of values.

B. Schedule of Values - Items in addition to Specification Sections.
   1. Mobilization
   2. Clean Up
   3. Building Permit
   4. Bonds, Insurance
   5. Misc. Mechanical Accessories
   6. Demolition
   7. Rough-In Labor - (Electrical)
   8. Rough-In Material - (Electrical)
   9. Finish Labor - (Electrical)
   10. Finish Material - (Electrical)
   11. Allowances (listed separately)
   12. Allowance Expenditure Authorizations with associated Change Proposal Requests
   13. Record drawings and close-out documents

14. Correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant for each applicable subcontractor
15. Submittals listed separately per mechanical, electrical and plumbing
16. Roof warranty as a line item
17. Donated items individually itemized at $0.00 (zero dollars).

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

A. Refer to following sample.

END OF SECTION 01 29 73

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Div. 1 - General Reqs.								
	Site Work General Conditions								
	Supervision								
	Mobilization								
	Bonds & Insurance								
	Permits								
	Contractor's Fee								
	Close-Out Documents								
	Div. 1 - Total								
	Div. 2 - Existing Conditions								
	Demolition (As applicable)								
	Erosion Control								
	Div. 2 - Total								
	Div. 3 - Concrete								
	Drill Piers								
	Caps & Beams								
	Slab on Grade								
	Cooling Tower Basin								
	Misc Bldg Conc								
	Floor Sealer								
	Rebar Matl								
	Rebar Labor								
	Lt.Wt.Insul Fill - Materials								
	Lt.Wt.Insul Fill - Labor								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 3 - Total								
	Div 4 - Masonry								
	Brickwork - Labor								
	Brickwork - Matls								
	Concrete Masonry - Labor								
	Concrete Masonry - Materials								
	Str. Glazed Tile-Labor								
	Str. Glazed Tile-Materials								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 4 - Total								
	Div 5 - Metals								
	Structural Steel - Labor								
	Structural Steel - Materials								
	Alternating Stairs								
	Misc. Steel - Materials								
	Steel Joists - Materials								
	Lt. Gauge Steel Framing-Labor								
	Lt. Gauge Steel Framing-Matls								
	Metal Decking - Labor								
	Expansion Joint Covers								
	Metal Decking - Matls								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Detailing								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 5 - Total								
	Div. 6 - Wood & Plastics								
	Rough Carpentry - Labor								
	Rough Carpentry - Materials								
	Millwork - Labor								
	Millwork - Materials								
	Submittals/Close-Out Documents								
	Div. 6 - Total								
	Div. 7 - Thermal and Moisture Protection								
	Waterpfng / Dampprfng-Matls								
	Waterpfng / Dampprfng-Labor								
	Building Insulation - Labor								
	Building Insulation - Materials								
	Fireproofing - Labor								
	Fireproofing - Materials								
	Metal Roof - Labor								
	Metal Roof - Materials								
	Metal Roof Guarantee								
	Built-up Roofing-Labor								
	Built-up Roofing-Materials								
	Built-up Roofing Guarantee								
	Roof Accessories								
	Building Sheet Metal - Labor								
	Building Sheet Metal - Matls								
	Bldg. Sheet Metal Guarantee								
	Roof Curbs								
	Roof Hatches								
	Sealants								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 7 - Total								
	Div. 8 - Doors and Frames								
	Finish Carpentry/Door - Labor								
	Finish Hardware - Matls								
	Thresholds & Seals - Matls+B66								
	Hollow Metal Doors & Frames - Matls								
	Plastic Faced Doors-Matls								
	Overhead Doors & Grilles-Labor								
	Overhead Doors & Grilles - Matls								
	Alum. Entrances & Store-fronts - Labor								
	Alum. Entrances & Store-								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	fronts - Matls								
	Alum. Windows - Labor								
	Alum Windows - Matls								
	Glass & Glazing-Labor								
	Glass & Glazing-Matls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 8 - Total								
	Div. 9 - Finishes								
	Lath & Plaster-Labor								
	Lath & Plaster-Matls								
	Gypsum Wallboard								
	Systems - Labor								
	Gypsum Wallboard								
	Systems - Matls								
	Ceramic Tile - Labor								
	Ceramic Tile - Matls								
	Quarry Tile - Labor								
	Quarry Tile - Matls								
	Terrazzo-Labor								
	Terrazzo-Matls								
	Acoustic Clg. - Labor								
	Acoustic Clg. - Matls								
	Acoustic Wall Panels								
	Resilient Flooring - Labor								
	Resilient Flooring - Matls								
	Carpet - Labor								
	Carpet - Matls								
	Athletic Flooring - Materials								
	Athletic Flooring - Labor								
	Floor Sealer								
	Painting - Labor								
	Painting - Mtls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 9 - Total								
	Div. 10 - Specialties								
	Visual Display Boards & Tackboards - Materials								
	Visual Display Boards & Tackboards - Labor								
	Toilet Partitions - Labor								
	Toilet Partitions - Matls								
	Louvers								
	Aluminum Flag Pole								
	Graphics								
	Lockers								
	Cubicle Curtains & Track								
	Fire Extinguisher Cabinets								
	Demountable Partitions-Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Demountable Partitions-Matls								
	Shelving								
	Toilet Room Accessories-Matls								
	Toilet Room Accessories-Lbr								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 10 - Total								
	Div. 11 - Equipment								
	Stage Curtains								
	Misc. Appliances								
	Food Service Eqpt-Labor								
	Food Service Eqpt-Matls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 11 - Total								
	Div. 12 - Furnishings								
	Horizontal Blinds								
	Projection Screens								
	Casework - Labor								
	Casework - Matls								
	Science Casework - Labor								
	Science Casework - Matls								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 12 - Total								
	Div. 13 - Specialties								
	Stage Curtains and Draperies								
	Music Instrument Storage								
	Bleachers								
	Press Box								
	Pre-eng. Metal Bldg.								
	Stadium Seating								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 13 - Total								
	Div. 14 - Conveying Systems								
	Platform Lifts								
	Elevators								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 14 - Total								
	Div. 21, 22 - Plumbing								
	Shop Drawings								
	As-Builts/Close-Out/ O&M Manuals								
	Sanitary Underground -								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Labor								
	Sanitary Underground - Matls								
	Storm Underground - Labor								
	Storm Underground - Matls								
	Domestic Water - Labor								
	Domestic Water - Matls								
	Plumbing Insulation - Matls								
	Plumbing Insulation - Labor								
	Gas Piping - Matls								
	Gas Piping - Labor								
	Grease Trap								
	Plumbing Fixtures - Matls								
	Plumbing Fixtures - Labor								
	Coordination Drawings								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 21, 22 Plumbing - Total								
	Div. 23 - Mechanical								
	Shop Drawings								
	As-Builts/Close-Out/ O&M Manuals								
	Chillers - Matls								
	Chillers - Labor								
	Cooling Towers - Matls								
	Cooling Towers - Labor								
	Boilers - Matls								
	Boilers - Labor								
	AHU's - Matls								
	AHU's - Labor								
	Fans - Matls								
	Fans - Labor								
	Grilles - Matls								
	Grilles - Labor								
	Ductwork - Matls								
	Ductwork - Labor								
	Pumps - Mtls								
	Pumps - Labor								
	Water Treatment - Labor								
	Water Treatment - Matls								
	Isolation - Labor								
	Isolation - Matls								
	Pipe Flex - Matls								
	Pipe Flex - Labor								
	Connections								
	Sheet Metal - Matls								
	Sheet Metal - Labor								
	Duct Insulation - Matls								
	Duct Insulation - Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Pipe Insulation - Matls								
	Pipe Insulation - Labor								
	VAV Boxes - Materials								
	VAV Boxes - Labor								
	Refrigerant Monitor - Matls								
	Refrigerant Monitor - Labor								
	Unit Heaters - Materials								
	Unit Heaters - Labor								
	Startup								
	Controls - Matls								
	Control - Labor								
	Engineer / Submittals								
	Modules / End Devices								
	Low Voltage Wiring								
	Startup								
	Close-Out Documents								
	Fire Sprinkler								
	Engineer / Submittals								
	Piping - Materials								
	Piping - Labor								
	Equipment - Materials								
	Equipment - Labor								
	Trimout - Materials								
	Trimout - Labor								
	Pipe, Valves, Fittings - Labor								
	Pipe, Valves, Fittings - Matls								
	Misc. - Matls								
	Insulation - Matls								
	Insulation - Labor								
	Sanitary Above Slab-Labor								
	Sanitary Above Slab-Matls								
	Storm Above Slab - Labor								
	Storm Above Slab - Matls								
	Gas - Labor								
	Gas - Matls								
	Fixtures - Labor								
	Fixtures - Matls								
	Permits								
	Coordination Drawings								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 23 Mechanical - Total								
	Div. 26 - Electrical								
	Mobilization+B220								
	Shop Drawings								
	As-Builts/Close-Out/ O&M Manuals								
	Underground								
	Conduit - Labor								
	Conduit - Matl								
	Wire - Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Wire - Matls								
	Feeder Wire - Labor								
	Feeder Wire - Matls								
	Switches/Recpt.								
	Switchgear - Labor								
	Switchgear - Matls								
	Temporary - Materials								
	Temporary - Labor								
	Gas Generator - Materials								
	Gas Generator - Labor								
	Fixtures - Labor								
	Fixtures - Matls								
	Communications - Labor								
	Communications - Matls								
	Fire Alarm - Labor								
	Fire Alarm - Matls								
	Security - Labor								
	Security - Matls								
	Low Voltage Ltng Sys-Matls								
	Low Voltage Ltng Sys-Labor								
	Voice System - Materials								
	Voice System - Labor								
	Video System - Materials								
	Video System - Labor								
	Data System - Materials								
	Data System - Labor								
	Master Clock - Materials								
	Master Clock - Labor+B277								
	Coordination Drawings								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 26 - Total								
	Divs. 31, 32 and 33 - Earthwork, Exterior Improvements and Utilities								
	Site Clearing & Grubbing								
	Building Pad - Materials								
	Building Pad - Labor								
	Paving Subgrade								
	Signage / Striping								
	Bike Racks								
	Landscaping - Materials								
	Landscaping - Labor								
	Hydro Mulch - Materials								
	Hydro Mulch - Labor								
	Irrigation - Materials								
	Irrigation - Labor								
	Earthwork								
	Finish Grading								
	Stabilization - Materials								
	Stabilization - Labor								
	Site Drainage - Materials								
	Site Drainage - Labor								

SECTION 01 29 73

SCHEDULE OF VALUES - SAMPLE

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Materials	Total Completed	%	Balance To Finish	Retainage
			Previous App.	This App.					
	Chain Link Fence-Materials								
	Chain Link Fence-Labor								
	Paving - Labor								
	Paving - Materials								
	Sidewalks								
	Submittals/Close-Out Documents								
	Supervision Clean-up								
	Div. 31, 32 and 33 - Total								
	General Conditions								
	Mobilization								
	Temp. Facilities								
	Final Cleaning								
	Record Documents/Close-out/ O&M Manuals								
	Supervision								
	Permits								
	Bonds								
	Insurance								
	Allowances								
	Alternates (list)								
	Change Orders								
	A. PR#								
	B. PR#								
	C. PR#								

END OF SECTION

SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination drawings.
   3. Pre-install meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific Contractor.

C. Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall arrange a meeting in the field with appropriate Architect's field representative(s) to obtain clarification as needed on items that may need interpretation. Requests for Information (RFI's) will not be allowed from the Contractor prior to onsite review and discussion with appropriate Architect's field representatives.

1.3 SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.4 COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other Contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate Contractors if coordination of the Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.
   9. Coordinate correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant.
   10. Coordinate inspections and other jurisdictional requirements.
   11. Coordinate OFCI equipment.
   12. Action items and issue logs.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to the Specifications Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade specific information to the coordination drawings by multiple Contractors in sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures, ductwork, piping, and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   e. Floor boxes.

8. Fire Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, sprinkler heads, and inspector test locations.

9. IDF/MDF Rooms: Communications and low voltage (security, data, phone, etc.) audio

10. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

11. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
   2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format.
   3. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
      Perform three dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
   4. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
      a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
      b. Digital Data Software Program: Drawings are available in Revit.
      c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.6 PROJECT MEETINGS

A. Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Architect to prepare the meeting agenda and distribute the agenda to all invited attendees.
   3. Minutes: The Architect will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Contractor, within three days of the meeting.
   4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.
   5. Issue logs: Documentation element of software project management and contains a list of ongoing and closed issues of the project.

B. Kick-off & Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that affect progress.
   4. Minutes: Architect will record and distribute meeting minutes.
   5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

C. Preinstallation Conferences: Conduct a preinstallation trade conference at site before each construction activity that requires coordination with other construction trades.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants. Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner, Architect and Engineer of Record of scheduled meeting dates.

2. Agenda: Contractor to review progress of other construction activities and preparations for the particular activity under consideration.
3. Contractor to record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Contractor to distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
6. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Substantial Completion.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout.
4. Minutes: Architect will record and distribute meeting minutes.
5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each Contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

4. Minutes: Architect will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
    b. Six (6) week look-ahead schedules.

5. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

F. Coordination Meetings: Conduct coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each Contractor present.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
4. Action Items: An element of work, design, research, or other task to be completed before a specific date or time, such as before a subsequent meeting of involved parties.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01 31 00

SECTION 01 32 00

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 10 00 – Summary.
2. Section 01 21 00 – Allowances.
3. Section 01 29 00 – Payment Procedures
4. Section 01 29 73 – Schedule of Values.
5. Section 01 33 00 – Submittal Procedures.

1.2 SUBMITTALS

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

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

C. Submit one opaque reproduction to be retained by the Contractor, plus two copies which will be retained by Architect.

D. Submit under transmittal letter specified in SECTION 01 33 00 – SUBMITTAL PROCEDURES.

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 and Owner. The Contractor shall execute 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 and the time limits current under the Contract Documents. 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 10 00 - SUMMARY.

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 dates reviewed submittals will be required from Architect. Show decision dates for selection of finishes. Reference SECTION 01 33 00 – SUBMITTAL PROCEDURES.

H. Show delivery dates required for Owner furnished products.

I. Coordinate content with SECTION 01 29 00 - PAYMENT PROCEDURES and SECTION 01 29 73 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 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Submittals: Written and graphic information and physical samples that require Architect's responsive action or are for information and do not require the architect’s action.

B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

C. Portable Document Format (PDF): An open standard file format used for representing documents in a device independent and display resolution independent fixed layout document format.

1.4 SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
   1. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
      a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      b. Digital Drawing Software Program: The Contract Drawings are available in Revit.

c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
d. The following digital data files will by furnished for each appropriate discipline:
   1) Floor plans.
   2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals. 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 15 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. Intermediate Review: If intermediate submittal is necessary, process in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Maximum allowable file size is 10MB except for shop drawing submittals. All submittals that are not shop drawings will be rejected if file size is larger than 10MB.
3. Name file with submittal number or other unique identifier, including revision identifier.
   a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
4. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
5. Transmittal Form for Electronic Submittals: Use software generated form from electronic project management software acceptable to Owner**,** containing the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
   d. Name of Construction Manager.
   e. Name of Contractor.
   f. Name of firm or entity that prepared submittal.

g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

6. Metadata: Include the following information as keywords in the electronic submittal file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals via email and the Architect’s project management program as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

   2. Certificates and Certifications Submittals: Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
a. Wiring diagrams showing factory installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in PDF electronic file.

C. Shop Drawings: Prepare Project specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full size drawings, submit Shop Drawings on sheet size indicated in specification section.
3. Submit Shop Drawings in PDF electronic file.
4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
a. Prepare Shop Drawings in same digital data software program, version, and operating system as the original Drawings.
b. Refer to Section 01 31 00 for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples: Submit full size units or Samples 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.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00.

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00.

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 and Section 01 29 73.

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Sections 01 45 00 and 01 45 23.

J. Closeout Submittals required for Substantial Completion: Comply with requirements specified in Section 01 77 00.

K. Maintenance Data: Comply with requirements specified in Section 01 78 23.

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated design drawing and data files into Building Information Model established for Project.
   1. Prepare delegated design drawings in the same digital data software program, version, and operating system as the original Drawings.

2.3 MSDS SHEETS

A. The Texas Asbestos Health Protection Rules (Title 25. Health Services, Part I. Texas Department of Health Chapter 295 - Occupational Health, Subchapter C - Texas Asbestos Health Protection) were approved and became effective on October 20, 1992, and amended March 27, 2003. The Rules established the procedures and means to implement the provisions of Senate Bill 1341 and House Bill 79.

B. Pursuant to the above referenced Rules, submit MSDS Sheets showing that materials used in the Project, contain 1.0 percent or less asbestos. This requirement pertains to every material in every Section of the Specifications, as applicable to the Project, whether written therein, or not. Submit MSDS Sheets for materials, including, but not limited to the following, as applicable to the Project.
   1. Surfacing Materials:
      a. acoustical plaster;
      b. decorative plaster/stucco;
      c. textured paint/coating;
      d. spray applied insulation;
      e. blown-in insulation
      f. fire proofing insulation;
      g. joint compound; and
      h. spackling compounds

   2. Thermal System Insulation:
      a. taping compounds (thermal)
      b. HVAC duct insulation;

c. boiler insulation;
d. breaching insulation;
e. pipe insulation; and
f. thermal paper products

3. Miscellaneous Material:
   a. cement wallboard/siding;
   b. asphalt/vinyl floor tile
   c. vinyl sheet flooring/vinyl wall coverings;
   d. floor backing;
   e. construction mastic;
   f. ceiling tiles/lay-in ceiling panels;
   g. packing materials;
   h. high temperature gaskets;
   i. laboratory hoods/table tops
   j. fire blankets/curtains;
   k. elevator equipment panels;
   l. elevator brake shoes;
   m. ductwork flexible fabric connections;
   n. cooling towers;
   o. heating and electrical ducts;
   p. electrical panel partitions;
   q. electrical cloth/electrical wiring insulation;
   r. chalkboards;
   s. roofing shingles/tiles;
   t. roofing felt;
   u. base flashing;
   v. fire doors;
   w. caulking/putties;
   x. adhesives/mastics; and
   y. wallboard

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

C. Incomplete submittals are not permitted, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents will be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 35 16 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Special procedures for alteration Work.

1.3 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of Work to be matched; it may be existing Work or Work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration Work for entire Project, including each activity to be performed, and

based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration Work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration Work activities to accommodate the following:
   a. Owner's continuing occupancy of portions of existing building.
   b. Owner's partial occupancy of completed Work.
   c. Other known Work in progress.
   d. Tests and inspections.
   e. Commissioning.
3. Detail sequence of alteration Work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration Work with circulation patterns within Project building(s) and site. Some Work is near circulation patterns [**and adjacent to restricted areas**]. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of Work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before commencing alteration Work, conduct conference at site.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration Work at regular intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Review items of significance that affect progress of alteration Work.
   a. Interface requirements of alteration work with other Project Work.
   b. Status of submittals for alteration Work.
   c. Access to alteration work locations.
   d. Effectiveness of fire prevention plan.
   e. Quality and work standards of alteration Work.
   f. Change Orders for alteration Work.

2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed.

B. Alteration Work Subschedule: Submit alteration Work subschedule within seven days of date established for commencement of alteration Work.

C. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration Work operations.

D. Alteration Work Program: Submit 30 days before Work begins.

E. Fire Prevention Plan: Submit 30 days before Work begins.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building Code: Comply with the IBC and the IEBC for alteration Work.
2. Fire Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire control devices during each phase or process. Coordinate plan with Owner's fire protection equipment and requirements. Include fire watch personnel's training, duties, and authority to enforce fire safety.
3. Safety and Health Standard: Comply with ANSI/ASSE A10.6.
4. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a *Lead-Safe Certified Firm* according to 40 CFR 745, Subpart E, and use only workers that are trained in lead safe Work practices.
5. Accessibility Requirements: Comply with applicable requirements.
   a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
   b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
   c. Texas Accessibility Standards (TAS).

B. Specialist Qualifications: An experienced firm having minimum 10 years documented experience that is regularly engaged in specialty Work similar in nature, materials, design, and extent to alteration Work specified.
1. Field Supervisor Qualifications: Full time supervisors experienced in specialty Work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on site when specialty Work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
   a. Construct new mockups of required Work whenever a supervisor is replaced.

C. Alteration Work Program: Prepare a written plan for alteration Work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole Project alteration Work program with specific requirements of programs required in other alteration Work Sections.
1. Dust and Noise Control: Include locations of proposed temporary dust and noise control partitions and means of egress from occupied areas coordinated with continuing on site operations and other known Work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:
1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:
1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction Work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction Work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 degrees F (3 degrees C) or more above the dew point.

E. Storage Space:
1. Owner will arrange for limited on site location(s) for free storage of salvaged material. Storage space [**includes**] [**does not include**] security and climate control for stored material.
2. Arrange for off site locations for storage, protection, and insurance coverage of salvaged material that cannot be stored and protected on site.

1.9 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs and/or preconstruction videos.

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling Work.

C. Owner's Removals: Before beginning alteration Work, verify in correspondence with Owner that the following items have been removed:
1. LIST SALVAGED ITEMS

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration Work.
   1. Use proven protection methods, appropriate to each area and surface being protected.
   2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration Work is being performed.
   3. Erect temporary barriers to form and maintain fire egress routes.
   4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration Work.
   5. Contain dust and debris generated by alteration Work, and prevent it from reaching the public or adjacent surfaces.
   6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
   7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
   8. Provide supplemental sound control treatment to isolate demolition Work from other areas of the building.

B. Temporary Protection of Materials to Remain:
   1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
   2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:
   1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration Work before commencing operations.
   2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration Work.
   3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of Work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin Work in an area until the drainage system is functioning properly.
   1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration Work.
   2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of Work in an area, install roofing protection.

3.2 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration Work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.3 ALTERATION WORK

A. Have specialty Work performed only by qualified specialists.

B. Ensure that Contractor supervisory personnel are present when Work begins and during its progress.

C. Record existing Work before each procedure (preconstruction), and record progress during the Work. Use digital preconstruction documentation photographs or video recordings.

D. Perform surveys of site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
   1. Do not proceed with the Work in question until directed by Architect.

END OF SECTION 01 35 16

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Laboratory Mockups: Full size physical assemblies constructed at testing facility to verify performance characteristics.
   2. Integrated Exterior Mockups: Mockups of exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
   3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations.
   1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, *experienced* means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Shop Drawings: Submit plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. <Determined by Architect based upon project requirements> Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting Work on the following systems:
   1. <Determined by Architect based upon project requirements> Main wind force resisting system or wind resisting component listed in the wind force resisting system quality assurance plan prepared by Architect.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.

3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality control service.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

C. Factory Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments,

judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

E. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.7 QUALITY ASSURANCE

A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated and with record of successful in service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling Work similar in material, design, and extent to that indicated for this Project, whose Work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Texas, experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products.

I. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

d. Build site assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect a minimum of seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting Work, fabrication, or construction. Allow **seven** days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Mockup of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies shall be constructed. Mockup, if not specifically shown on the drawings, shall be minimum 8’x8’. Mockup shall include all major façade elements and at least one window minimum 2’x2’ in size. Prior to constructing mockup verify requirements with architect. Pre-installation conferences for trades involved in Integrated Exterior Mockup shall be held after mock up is completed.

M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

N. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300.

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner:

B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections.
   1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 35 16 Alteration Project Procedures.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 40 00

SECTION 01 45 00 - TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements and qualifications including but not limited to:
   1. Professional testing and laboratory services.
   2. Accessories necessary for the completion of testing and laboratory services.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
   4. Specific test and inspection requirements are not specified in this Section.

C. A qualified independent testing laboratory and/or geotechnical engineering service selected and paid by Owner.
   1. The Owner will pay for the initial laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents.

D. Inspecting agency shall perform inspections and tests in accordance with the rules and regulations of the building code, local authorities, Specifications of ASTM, and the Contract Documents.

E. Materials and workmanship found not in compliance with required standards or performance obligations shall be removed and replaced. Replacement and subsequent testing shall be at Contractor’s expense.

F. Where terms “Inspector” and “Laboratory” are used, it is meant and in reference to an officially designated and accredited inspector of the testing laboratory or geotechnical service engaged by Owner.

G. Laboratory inspections shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

H. Contractor or Fabricator shall cooperate with the testing laboratory in matters pertaining to the Work.

I. Contractor to address deficiency and failed reports.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329 and ASTM E534; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
   3. Testing agencies shall be insured against errors and omissions by a professional liability insurance policy having a minimum limit of liability of $500,000.00.

B. Inspection and testing services of the testing agency shall be under the direction of a Registered Engineer licensed in the State of Texas, charged with engineering managerial responsibility, and having a minimum of five (5) years engineering experience in inspection and testing of construction materials.

C. Concrete Inspectors: Inspecting personnel monitoring concrete Work shall be ACI certified inspectors.

D. Structural Steel: Primary inspectors performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, *Standard and Guide for Qualification and Certification of Welding Inspectors*.
   1. Inspector may be supported by assistant inspectors who perform specific inspection functions under the direct supervision of the Primary Inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). Work of assistant inspectors shall be monitored daily by the inspector.

E. Testing Equipment: Equipment shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards.

F. Referenced Standards: Latest adopted edition of standards referenced apply to the Work. In the event of conflict between the Contract Documents and referenced standards, the Contract Documents shall govern. In case of conflict between Contract Documents and the Building Code, the more stringent shall govern.

1.4 QUALITY CONTROL

A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Refer to the individual specification sections for specific requirements.

2. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
3. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
4. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
5. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
6. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
7. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
8. Associated Responsibilities and Services: Cooperate with agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
    a. Provide access to the Work.
    b. Deliver of samples to testing laboratory, without cost to Owner, in adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
    c. Advise laboratory and Architect sufficiently in advance of construction operations to allow laboratory to complete required inspections or tests and to assign personnel for field inspection and testing as specified.
    d. Provide facilities for storage and curing of concrete test samples on site for the first 24 hours and for subsequent field curing required by ASTM C31.
    e. Incidental labor, facilities, and equipment necessary to assist laboratory personnel in obtaining and handling samples at the site.
    f. Preliminary design mix proposed for use for material mixes that require control by testing agency.
    g. Provide concrete mix designs in accordance with ACI 301 Section 3.9 made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, select and pay for laboratory.
    h. Obtain required inspections or approvals of the building official. Inspection requests and notifications required by building code are responsibility of the Contractor.
    i. Provide current welder certificates for each welder employed.
    j. Provide fabrication and erection inspection and testing of welds in accordance with AWS D1.1, Chapter 6.
        1) Use prequalification of welding procedures in executing the Work.
    k. Security and protection for samples and for testing and inspecting equipment at Project site.

9. Retesting/Reinspecting: Regardless of payment responsibility of the original tests or inspections, provide quality control services, including retesting and reinspecting, for construction that replaced Work failing to comply with the Contract Documents or Code requirements.

C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

D. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.5 AUTHORITY AND DUTIES OF LABORATORY PERSONNEL

A. A representative of the testing laboratory, who has reviewed and is familiar with the project and specifications, shall participate in preconstruction conferences. The representative shall coordinate material testing and inspection requirements with the Contractor and its subcontractors consistent with the planned construction schedule. The laboratory representative shall attend conferences required or requested to address quality control issues.

B. Laboratory personnel shall inspect and test materials, assemblies, specimens, and Work performed, including design mixes, methods and techniques and report the progress to the Architect.

C. If material or Work fails to meet requirements of Contract Documents, laboratory inspector shall notify the Construction Manager, Architect, Engineers, supplier or subcontractor providing or preparing the materials or Work being tested of such failure.

D. Laboratory personnel shall not perform the Work of the Contractor or act as foremen or superintendents. Work will be inspected as it progresses, but failure to detect defective Work or materials shall not prevent later rejection when a defect is discovered.

E. Laboratory personnel are not authorized to revoke, alter, relax, enlarge, or release the requirements of the Contract Documents or approve or accept portions of Work, except where approval is specifically specified in the Specifications.

F. Comply with building code requirements for Special Inspections.

1.6 SUBMITTALS

A. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality control service.

C. Test and Inspection Reports: Prepare and submit certified written reports specified. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

D. Submit copies of reports of each inspection and test:
   1. Owner, Program or Project Manager, Architect, and each Engineer or outside consultants regarding their particular phase of the project: One copy each.
   2. Construction Manager and Contractor: Two copies each.

E. In addition to furnishing a written report, notify Construction Manager and Contractor verbally of uncorrected conditions or failures to comply with requirements of the Contract Documents, and immediately fax and email corresponding report to the Architect and Engineer.

F. At completion of each trade or branch of Work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of Work and full compliance with requirements of Contract Documents.

G. Submit copies of test results sealed by a Registered Engineer to municipal authorities having jurisdiction, as required.

1.7 TESTING LABORATORY GUIDELINES AND PROCEDURES

A. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap, i.e. earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the site.

B. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for hours over eight hours spent at the site on a single day, field testing services performed on a Saturday or Sunday, and field services performed on a recognized holiday.

C. There shall be a three hour minimum for each scheduled testing service. Vehicle charges will be included on a $25.00 per trip basis.

D. Cylinder pick up will be controlled by the technician performing test on a scheduled pick up day. If there are no testing services scheduled, the cylinder pick up fee is $40.00 on week days and $50.00 on weekends and holidays with no technician or vehicle charge.

E. The Contractor shall bear the responsibility of scheduling the testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services.

Cancellations or failed test shall be reimbursable to the Owner by the responsible party for the cancellations or failure of a test or service.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.
   5. Deficiency log.

B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 TESTING AND INSPECTION SERVICES

A. Testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain specification compliance and which may be deemed necessary by Architect, Engineer, or Owner to ensure the quality of the Work.

B. The Owner reserves the right to add to or delete any or all inspection and testing specified, excluding testing required by the applicable building codes.

C. If conflicts arise between Drawings and Specifications, notify Architect immediately. The most stringent requirements shall dictate procedure.

3.3 TESTING OF EARTHWORK

A. Testing Services (As specified or required):
   1. References (As applicable for tests required):
      a. American Society for Testing and Materials (ASTM)
         1) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)
         2) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
         3) D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
      b. American Association of State Highway and Transportation Officials (AASHTO)
         1) T89, Determining the Liquid Limit of Soils
         2) T90, Determining the Plastic Limit and Plasticity Index of Soils
         3) T99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop
         4) T238, Density of Soil and Soil Aggregates In Place By Nuclear Methods (Shallow Depth)

   2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slab on grade, and backfills.

3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
5. Determine Liquid Limit in accordance with ASTM D4318 or AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material,
6. Perform one in place density test for each 4,000 square feet (445 square yards) of existing subgrade material.
7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
8. Perform in place density tests of each lift of compacted fill at locations adequate to evaluate the degree of compaction of all fill areas. Conduct one test for each 4,000 square feet (445 square yards) of each lift of compacted fill.
9. Perform testing at a frequency of one in-place density and moisture test for each 75 lineal feet or less of utility trench, with a minimum of three tests per lift

B. Reports: Submit reports with the following information:
1. Type and condition of soil at footing bottoms.
2. Level of water table in the excavated areas.
3. Grain size distribution of fill materials (average of three tests).
4. Moisture density test results.
5. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
6. Notify Architect by telephone within one hour of the discovery of the following conditions and follow up telephone notification with written report.
   a. Materials used, or degree of soil compaction not meeting specified requirements.
   b. Frost and freeze protection requirements for excavation bottoms not being complied with.
   c. Water in excavations which is not being removed prior to Work being performed in excavation.

3.4 INSPECTION OF PIPED SITE UTILITIES

A. Laboratory representative shall observe and report on the following:
1. Proper alignment and grade of trenches.
2. Pipe bedding and supports.
3. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
4. Installation of pipe and joints.
5. Testing of piped utilities performed by Contractor.

3.5 PAVING

A. Testing Services: Perform field tests for moisture density properties:
1. Provide field testing of the subgrade as specified.
2. Paving Subbase: Provide one field test for every 7,500 square feet of area of crushed limestone or caliche subbase.
3. Lime Treated Subgrade: Provide one field test for every 7,500 square feet of area of lime treated subgrade for content of lime and subgrade compaction.
4. Cement Soil Stabilization: Provide one field test for every 7,500 square feet of area of cement stabilized subgrade for content of cement and subgrade compaction.

3.6 PIER DRILLING OPERATION

A. A representative of a qualified geotechnical laboratory shall provide services specified.

B. Laboratory representative shall make continuous inspections to determine that proper bearing stratum is obtained and utilized for bearing and that shafts are properly clean and dry before placing concrete.

C. Laboratory shall furnish complete pier log showing the diameter, top and bottom elevations of each pier, casing required or not required, actual penetration into bearing stratum, elevation of top of bearing stratum, volume of concrete used, and deviations from specified tolerances.

D. Laboratory representative shall make continuous inspections of drilled pier construction to check the following:
1. Verify soundness of bearing stratum and desired penetration.
2. Verify pier dimensions and reinforcing used.
3. Monitor condition of hole and removal of water and loose material from bottom.
4. Monitor placement of concrete and use of tremie or pumps.
5. Monitor the extraction of casing, if used.

E. Request probe holes when deemed necessary to confirm safe bearing capacity.

3.7 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspect concrete reinforcing steel prior to placing concrete for compliance with Contract Documents and approved shop drawings. Noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and, if left uncorrected, reported to the Architect.

B. Laboratory representative shall observe and report on the following:
1. Number and size of bars.
2. Bending and lengths of bars.
3. Splicing.
4. Clearance to forms, including chair heights.
5. Clearance to sides and bottom of trench if soil formed.
6. Clearance between bars or spacing.
7. Rust, form oil, and other contamination.
8. Grade of steel.
9. Securing, tying, and chairing of bars.
10. Excessive congestion of reinforcing steel.
11. Installation of anchor bolts and placement of concrete around such bolts.
12. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
13. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years' experience inspecting reinforcing steel in projects of similar size.

3.8 CONCRETE INSPECTION AND TESTING

A. Receive and evaluate proposed concrete mix designs submitted by Contractor. If mix designs comply with Drawings and Specifications, the laboratory shall submit a letter to the Architect certifying compliance. Mix designs not complying with Drawings and Specifications shall be returned by the laboratory as being unacceptable. Check the proposed mixes for proportions, water cement ratio and slump in accordance with ACI 613 and 318.

B. Comply with ACI 311 *Guide For Concrete Inspection* and ACI *Manual of Concrete Inspection* (SP-2).

C. Sample and test concrete placed at the site in accordance with ASTM C172. Each sample shall be obtained from a different batch of concrete on a random basis.

D. Test concrete:
   1. Mold and cure five specimens from each sample.
      a. For each 50 cubic yards or fraction thereof of structural building concrete; and
      b. For each 100 cubic yards or fraction thereof of nonstructural concrete and site Work paving and sidewalks.
      c. Laboratory cure two cylinders in accordance with ASTM C192.
      d. Field cure remaining cylinders in accordance with ASTM C31.

   2. Two specimens shall be tested at seven days for information, two shall be tested at 28 days for acceptance.

E. Deviations from the requirements of ASTM Specifications shall be recorded in the test report. Test concrete specimens in accordance with ASTM C39.

F. Specimens for pumped concrete shall be taken at the discharge end of pumping equipment.

G. Supervise curing and protection provided for test specimens in field, and transportation from the field to laboratory. Test cylinders shall be stored in the field 24 hours and then carefully transported to laboratory and cured in accordance with ASTM C31.

H. Make one strength test (four cylinders) of each mix design of concrete placed in any one day.

I. Make one slump test for each set of cylinders following procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever consistency of concrete appears to vary. Slump tests corresponding to samples from which strength tests are made shall be reported with strength test results. Other slump tests need not be reported.

J. Determine total air content of air entrained normal weight concrete sample for each strength test in accordance with ASTM C231.

K. Determine air content and unit weight of lightweight concrete sample for each strength test in accordance with ASTM C173 and ASTM C567.

L. Determine temperature of concrete sample for each strength test.

M. Inspect each batch of concrete, monitor addition of mixing water to assure uniform consistency from truck to truck. Check mixing form mixers before mix begins to set and within time limits set forth in ASTM C94.
   1. Monitor addition of water and high range water reducer to concrete at job site and length of time concrete is allowed to remain in truck during placement.

N. Testing agency shall furnish and maintain a competent inspector at the mixing plant at the start of each day's mixing. Inspector shall examine concrete materials for compliance with Specifications and approved mix design, weighing and measuring devices, proportioning and mixing of materials, water and cement content of each batch, general operation of the plant, and transportation of concrete to jobsite. Inspector shall verify that amount of free surface moisture contained in fine and course aggregate has been properly accounted for in the concrete mixing to achieve required consistency and water cement ratio.

O. Testing laboratory shall monitor addition of water to concrete at the jobsite and the length of time concrete is allowed to remain in the truck before placement. Inspector shall compare mixture with criteria on the approved mix design and report any significant deviation to the Architect, Contractor and concrete supplier. Do not permit addition of water which will exceed maximum water/cement ratio for the mix as given on the approved mix design.

P. Observe placing of concrete, except nonstructural slabs on grade and site Work. Observe and report on placing method, consolidation, cold joints, length of drop, and displacement of reinforcement. Report deficiencies to Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

Q. Test reports shall include but no be limited to the following information: date of concrete placement, concrete mix identification number or proportion of ingredients, truck ticket number, time test was made, time of batching, location of each placement, slump, unit weight, water content (microwave test) and air content of concrete sampled and date and results of strength test.

R. Report promptly to Architect all details of reasons for rejection of any and all quantities of concrete. Give all information concerning locations of the concrete pours, quantities, date of pours, and other pertinent facts concerning concrete represented by the specimens.

S. Testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and time at which cement and aggregate were dispensed into the truck, and time at which concrete was discharged from the truck.

T. Evaluation and Acceptance:
   1. If measured slump, or air content of air entrained concrete, falls outside specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, concrete shall be considered to have failed to meet the requirements of the specifications, and shall not be used in the structure.
   2. Strength level of concrete will be considered satisfactory if the averages of sets of three consecutive strength tests results are equal to, or exceed, specified strength and no individual test result (average of two cylinders) is below specified strength by more than 500 psi.
   3. Completed concrete Work will be accepted when requirements of ACI 301 Chapter 18 *Specifications for Structural Concrete for Buildings* have been met.

U. Concrete Test Reports: Reports shall be made and distributed immediately after respective tests or inspections are made.
   1. Where reports indicate deviations from Contract Documents, they shall also include a determination of the probable cause of deviation and where applicable, a recommendation for corrective action.

V. Furnish a statistical analysis for each class of concrete placed on the project in accordance with ACI 214 and ACI 318. Information shall be updated and distributed once a month as directed by the Architect. Information shall include, but not be limited to, the following:

1. Strength tests at 7 days of one cylinder.
2. Strength tests at 28 days of two cylinder averages.
3. 28 day moving average strength tests of last three test groups.
4. Standard deviation and coefficient of variation based on 28 day strength tests.
5. Average strength and number of 28 days tests for most recent month.

W. Test Footings (Shafts) (Piers) (Caissons): Same diameter and type specified for footings, placed in same manner. Accepted test footings may be used in the Work.

X. Noncompliant Test Reports: Fax test reports indicating noncompliance immediately to each party on the test report distribution list. Copies shall be on different colored paper.

Y. Inspect application of curing compound and monitor curing conditions to assure compliance with specification requirements. Report curing deficiencies to the Contractor immediately and submit a written report to the Architect.

3.9 TESTING OF NONSHRINK GROUT

A. Make one strength test for all plates grouted and for all grout used in joints between members.

B. Each test shall consist of four cubes, two tested at 7 days and two at 28 days, made and tested in accordance with ASTM C109, with the exception that grout shall be restrained from expansion by a top plate.

3.10 STRUCTURAL STEEL

A. Inspect structural steel during and after erection for compliance with Contract Documents and shop drawings. Review and report on fabricator's quality control procedures and capabilities.

B. Field Inspection:
1. Proper erection of pieces.
2. Proper touch up painting of shop primed structural steel exposed to view or in crawl space.
3. Proper installation of bolts.
4. Plumbness of structure and proper bracing.
5. Proper field painting.
6. Initial inspection of welding process and periodically thereafter as necessary.
7. Visual examination of completed welds.
8. Ultrasonic testing of penetration field welds.
9. Installation of field welded shear studs.
10. Inspect shop fabricated members, upon arrival at the site, for defects incurred during transit and handling.
11. Measure and record camber of beams upon arrival and before erection for compliance with specified camber. Measure lying flat with web horizontal. Return members outside specified camber tolerance to shop for correction.

C. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders employed on Work, along with certification that each welder has passed qualification tests within the past 12 months, using procedures covered in AWS D1.1 *Structural Welding Code - Steel*. Verify welder qualifications.

D. Inspection of field welding shall include:
1. Visually inspect fillet welds for size, soundness, and proper return around ends. Inspect seams, folds, and delaminations.
2. Visually inspect welds for proper repair of painting.

3. Ultrasonically test penetration welds in accordance with ASTM E164.
4. Inspect surfaces to be welded. Note surface preparations, fit up, and cleanliness of surface. Verify electrodes for size, type, and condition.
5. Welding inspector shall be present during alignment and fit up of members being welded, and shall verify for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, inspector shall order the joint to be chipped down to sound metal, or gouged out, and rewelded. Thoroughly inspect root passes for cracks. Gouge out cracks and rewelded to 2 inches beyond each end of crack.
6. Inspector shall verify that welds have been marked with welder's symbol and shall mark welds requiring repairs and reinspection. Inspector shall maintain a written record of welds. Work completed and inspected shall receive an identification mark by the inspector. Identify unacceptable material and Work identified by word *reject* or *repair* marked directly on the material.
7. Testing agency shall advise the Owner and Architect of any shop and/or field conditions which may require further tests and examination by means other than those specified. Additional tests and examinations shall be performed as authorized by the Owner and Architect.
8. Owner reserves the right to use ultrasonic or radiographic inspection to verify adequacy of welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
9. Weld quality to comply with the American Institute of Steel Construction (AISC) Manual of Steel Construction.
10. Determine percentage of weld tested by the number of welds that fail the initial testing.
11. Reweld and retest welds that fail until the welds pass. Test two additional welds for every weld failure.

E. Inspect bolted construction in accordance with AISC *Specification for Structural Steel Buildings*:
1. Visually inspect bolts ensuring that plies have been brought into snug contact.
2. Inspect high strength bolt in accordance with Section 9 of the *Specifications for Structural Joints Using ASTM A325 or A490 Bolts*.

F. Inspect stud welding in accordance with Section 7.8, of AWS D1.1 *Structural Welding Code*:
1. Weld at least two shear studs at the start of each production period to determine correct generator, control unit, and stud welder setting. The studs shall be capable of being bent 45 degrees from vertical without weld failure.
2. When the temperature is below 32 degrees F (0 degrees C), test one stud in each 100 after cooling. Do not weld studs at temperatures below 0 degrees F or when surface is wet with rain or snow. If stud fails in the weld, two new studs shall pass the test before resumption of welding.
3. Visually inspect studs for compliance with the requirements of the Contract Documents. Verify number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, that stud shall be struck with a hammer and bent 15 degrees off perpendicular in the direction away from the missing weld. Studs failing test shall be replaced.

3.11 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:
1. Visually inspect and report on completed condition of each mechanical splice of reinforcing steel.
2. Visually inspect each mechanical splice to ensure compliance with the ICC-ES Reports and the manufacturer's published criteria for acceptable completed splices.
3. Place special emphasis on the inspection of the end preparation of each bar to be spliced required by the ICC-ES Report.

B. Reports: Submit reports to Architect:
   1. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
   2. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Indicate reasons for rejection on each report.

3.12 OPEN WEB JOISTS AND JOIST GIRDERS

A. Inspect joists at jobsite for compliance with specified fabrication requirements. Verify welded connections between web and chord, splices, and straightness of members.

B. Inspect installation of joists at jobsite. Check connections to supporting members, chord extensions, number of rows of bridging, and bridging connections for compliance with Contract Documents and referenced standards.

C. Verify welder qualification certificates for both shop and field welding operators.

3.13 METAL FLOOR DECK

A. Field inspection shall consist of:
   1. Verifying types, gauges and finishes for compliance with Contract Documents and shop drawings.
   2. Examine composite floor deck exposed to crawl space for damage to galvanizing due to welding or construction activities. Repair galvanized composite floor deck in accordance with the specifications.
   3. Examine the erection of metal deck, fastenings, reinforcing of holes, deck reinforcing, miscellaneous deck supports, hanger tabs, shear studs, deck closures, painting or other coating.
   4. Certification of welders.
   5. Inspect and test field welded shear studs used to fasten metal floor decking to supporting steel as specified for structural steel.

3.14 METAL ROOF DECK

A. Field inspection shall consist of:
   1. Verify types, gauges and finishes for compliance with Contract Documents and shop drawings.
   2. Examine the erection of the metal deck, including fastenings at supports and side laps, reinforcing of holes, and miscellaneous deck supports.
   3. Certification of welders.
   4. Visual inspection of at least 25 percent of welds.

3.15 SPRAYED FIREPROOFING

A. Verify applied thickness, density, and bond strength of sprayed fireproofing meets fire rating requirements of approved design.

B. Verify installation complies with fire rating requirements of approved design.

C. Inspect and test for thickness:
   1. Test 25 percent of structural frame columns and beams in each building level.
   2. Test 10 percent of beams other than structural frame in each building level.
   3. Test one slab per 5,000 square feet of building area.

D. Inspect and test in accordance procedures of ASTM E605 and ASTM E736.

3.16 EXPANSION BOLT INSTALLATION

A. Inspect drilling of each hole and installation of each expansion bolt for compliance with Contract Documents and shop drawings.

B. Verify installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

3.17 LIGHTWEIGHT INSULATING CONCRETE FILL

A. Inspection and Observation Services (As required):
   1. Inspection of roof deck prior to start of Work.
   2. Inspection during installation of insulation and lightweight insulating concrete fill Work to ascertain compliance with Contract Documents.
   3. Observation of base ply fastener pull tests performed by Contractor to ascertain minimum withdrawal resistance of 40 pounds per fastener.

B. Testing Services (As required):
   1. References (As applicable for tests required):
      a. American Society for Testing and Materials (ASTM)
         1) C177, Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded Hot Plate Apparatus
         2) C495, Test Method for Compressive Strength of Lightweight Insulating Concrete
         3) C578, Specification for Rigid, Cellular Polystyrene Thermal Insulation.

   2. Test EPS insulation board for thermal insulation value in accordance with ASTM C177.
   3. Test lightweight insulating concrete fill in accordance with ASTM C495 for:
      a. Mix design compressive strength.
      b. Mix design wet and dry density range.
      c. Number of Tests:
         1) One per 5,000 square feet.
         2) Not less than one for each day's Work.

   4. Test EPS insulation board for density in accordance with ASTM C578.

3.18 TESTING OF ROOFING

A. Inspection and Observation Services (As required):
   1. Inspection of roof deck prior to start of Work.
   2. Inspect on site condition of stored roofing materials.
   3. Inspection during roofing, roof insulation, and sheet metal Work to ascertain compliance with Contract Documents.
   4. Observation of roof test cuts performed by Contractor to ascertain that they are properly made.
   5. Observation of patching of roof test cuts to ascertain that they are properly made.

B. Testing Services (As required):
   1. Perform dissection and analysis on cuts provided by Contractor to confirm number of plies, bonding of plies, weight of bitumen and softening temperature to ascertain compliance with specifications.

3.19 MASONRY

A. Inspection and Observation Services:
   1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
   2. Review mortar design mixes.
   3. Inspection of laying, mortaring, and grouting of concrete masonry units and elements.

B. Testing Services:
   1. References (As applicable for tests required):
      a. ASTM International (ASTM)
         1) C140, Standard Test Methods of Sampling and Testing Concrete Masonry Units
         2) C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
         3) C1019, Standard Test Method for Sampling and Testing Grout
         4) E447-97, Standard Test Methods for Compressive Strength of Laboratory Constructed Masonry Prisms.

   2. Testing of Concrete Masonry Units (CMU):
      a. Preconstruction: Perform the following tests in accordance with ASTM C140.
         1) Compressive Strength
         2) Absorption
         3) Weight
         4) Moisture Content
         5) Dimensions.

   3. Mortar Tests:
      a. Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used on the Project.
      b. 28 Day Compressive Strength
      c. Water Retention
      d. Construction: Perform 28 day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one test per 2,000 square feet of masonry.

   4. Refer to and include Work for reinforcing steel specified.
   5. Grout Tests:
      a. Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.
         1) 28 Day Compressive Strength
         2) Construction: Perform 28 day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 square feet of masonry.
         3) Prism Test: Perform preconstruction 28 day compressive strength test on concrete masonry walls in accordance with ASTM E447-97, Method B.

3.20 REPAIR AND PROTECTION

A. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible

as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 35 16 Alteration Project Procedures.

B. Protect construction exposed by or for quality control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality control services.

END OF SECTION 01 45 23

01 45 23 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

1.1.1. Specifications throughout all Divisions of the Project Manual, which pertain to operable and non-operable equipment and/or building systems, are directly applicable to this Section, and this Section is directly applicable to them.

1.2. SUMMARY

1.2.1. This Section establishes general and administrative requirements pertaining to commissioning of equipment, devices, and building systems on the project. Technical requirements for commissioning of particular systems and components are established in the respective technical sections of this Project Manual.

1.2.2. It is of primary concern that all operable systems installed in the Project perform in accordance with the Contract Documents, the Owner's Project Requirements (OPR) and the Basis of Design (BOD). During Commissioning, the Contractor systematically demonstrates to the Owner or Owner's representative that the operable systems have been installed and performing in strict accordance with the Contract Documents.

1.2.3. Commissioning requires cooperation and involvement of all parties throughout the construction process. The Contractor shall deliver a successful Commissioning process. Successful Commissioning requires that installation of all building systems complies with Contract Document requirements and that full operational check-out and necessary adjustments are performed prior to Substantial Completion with the exception of Deferred tests approved in advance by the Owner.

1.2.4. Commissioning will encompass and coordinate traditionally separate functions of system documentation, installation checkout, System Verification Checklists and start-up, control system calibration and point-to-point checkout, testing, adjusting, and balancing, Functional Performance Tests, Integrated System Tests, Contractor demonstration to the Owner, and training of Owner's personnel. This requires assembling all related documentation into one cohesive collection. Commissioning is intended to achieve the following specific objectives of the Contract Documents:

1.2.4.1. Verify and document proper installation and intended performance of equipment, systems, and integrated systems.

1.2.4.2. Ensure that operating and maintenance and Commissioning documentation requirements are complete.

1.2.4.3. Provide the Owner with functional buildings and systems that meet the Contract Document requirements and the Owner's Project Requirements (OPR) at Substantial Completion.

1.3. DEFINITIONS

1.3.1. Basis of Design (BOD): A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

1.3.2. Commissioning (Cx): A systematic process confirming that building systems have been installed, properly started, and consistently operated in strict accordance with the Project Documents, that

all systems are complete and functioning in accordance with the Contract Documents at Substantial Completion, and the Contractor has provided the Owner adequate system documentation and training.

1.3.3. Commissioning Authority (CxA): Party having a contractual agreement with the Owner to provide third party commissioning services as defined herein under Commissioning Authority's Role and Responsibilities. Commissioning Authority may represent the Owner and is authorized to act on behalf of the Owner. The Commissioning Authority does not have authority to alter design or installation procedures without the written approval of the Owner or the design team.

1.3.4. Contract Documents: The General Conditions, Drawings, Specifications, Addenda, and other documents developed by the A/E Team and approved by the Owner that constitute the contractual obligations of the project scope.

1.3.5. Control Point and Sensor Calibration Verification: Process of verifying the point integrity and/or sensor calibration from the physical point of monitoring (sensor, contact, actuator, etc.) to the digital point location at the Operator's interface within the respective control system (Building Automation, Lighting Controls, Power Status and Monitoring, etc.).

1.3.6. Deferred Testing: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other site conditions that prohibit the test from being performed prior to Substantial Completion.

1.3.7. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Project Documents.

1.3.8. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems executed by the Contractor and witnessed by the CxA. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are operated through all specified sequences of operation. Components are verified to be responding in accordance with requirements in the Project Documents.

1.3.9. Functional Performance Testing Procedures: Commissioning protocols, detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly.

1.3.10. Integrated Systems Test (IST): Test of dynamic function and operation of multiple systems. Integrated Systems Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project Documents.

1.3.11. Integrated Systems Testing Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.

1.3.12. Operational Testing: Activities and testing occurring after initial energizing and/or start-up of equipment that determine whether equipment is operating within the manufacturer's recommendations and the design requirements. These activities are intended to ensure that equipment and systems meet all warranty requirements and are ready for Functional Performance Testing. Common examples are Testing, Adjusting and Balancing of HVAC systems and initial load testing of electrical equipment.

1.3.13. Owner's Project Requirements (OPR): A written document that details the functional requirements of a project and the expectations of how the facility will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria and supporting information.

1.3.14. Project Documents: Consists of the Contract Documents, Approved Submittals, Requests for Information (RFI), Vendor documentation, Operations and Maintenance (O&M) information and other documentation that determines the requirements for acceptable installation and operation of the specific equipment and systems on the project.

1.3.15. System Verification Checklist (SVC): A list of static inspections and material or component tests that verify proper installation of equipment (e.g., belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.), start-up activities and documentation, as well as operational testing results. The checklists are meant to document all activities for an individual piece of equipment from procurement on the project through operational testing are performed in accordance with the requirements in the project documents.

1.3.16. Start-up: The activities where equipment is initially energized, tested and operated. Start-up is completed prior to Operational Testing and Functional Performance Testing and is an integral item documented in the System Verification Checklist (SVC).

1.3.17. Training Plan: A detailed plan prepared by the Contractor and reviewed by the Owner and Commissioning Authority that outlines the training activities, instructors, time durations, and system requirements in accordance with the Contract Documents and Commissioning Plan.

1.3.18. Trending: Data collection of monitored points using the Building Automation System, Lighting Controls System, Power Status and Monitoring System or independent data acquisition instrumentation.

1.4. COMMISSIONING TEAM

1.4.1. Owner shall appoint the following Members:

1.4.1.1. Owner's Project Manager and any other designated representatives of the Owner's staff.

1.4.1.2. Commissioning Authority (CxA)

1.4.1.3. Architect/Engineer (A/E)

1.4.1.4. Test, Adjust and Balance Firm (TAB) – may be sub-contracted to the CxA

1.4.2. Contractor shall appoint the following Members:

1.4.2.1. Individuals, each having authority to act on behalf of the entity they represent, explicitly organized to implement the Commissioning process through coordinated actions. At a minimum, the Contractor shall designate a Commissioning Coordinator and each major sub-contractor (Mechanical, Electrical, Plumbing, Building Automation) shall have a dedicated representative.

1.4.2.2. Vendor representatives (as needed) required for start-up, operational testing, Functional Performance Testing, Integrated Systems Testing, and Owner Training activities.

1.4.2.3. Representatives of independent testing agencies (Test, Adjust and Balance, Electrical Testing Agency, etc.)

1.5. ROLES AND RESPONSIBILITIES

1.5.1. Roles and responsibilities of Commissioning Team members related to the Commissioning Process are provided in this Section. The respective entities defined below shall fulfill the listed roles and responsibilities as contained herein. Specific technical roles and responsibilities are defined in other sections of the Project Specifications.

1.5.2. Owner's Roles and Responsibilities:

1.5.2.1. Provide guidance in development of the Owner's Project Requirements (OPR).

1.5.2.2. Review Technical Specifications containing Commissioning requirements.

1.5.2.3. Approve the Commissioning Scope of Work and schedule of Commissioning activities.

1.5.2.4. Assign Owner's representatives and schedule them to participate in Commissioning activities, including the following:

1.5.2.4.1. Commissioning Team meetings.

1.5.2.4.2. Review and approval of the Commissioning Plan, Training Plan, System Verification Checklist templates, Functional Performance Test Procedures, Integrated Systems Test Procedures, Deferred Testing Plans, Final Commissioning Process Report, Systems Manual, Measurement and Verification Plan and other Commissioning documents.

1.5.2.4.3. Attend Owner Training sessions in operation and maintenance of systems and equipment.

1.5.2.4.4. Observation of Contractor's demonstration of systems and equipment operation.

1.5.3. Commissioning Authority's (CxA) Roles and Responsibilities:

1.5.3.1. Prepare the Commissioning Plan with the Owner's and Contractor's review and input.

1.5.3.2. Periodically attend and/or review the proceedings of the regular Construction Meetings hosted by the Contractor to understand the progress of construction activities on the project.

1.5.3.3. Conduct and document Commissioning Team meetings including the Commissioning Kickoff Meeting.

1.5.3.4. Perform site visits as necessary to observe component and system installations prior to energizing or start-up of equipment and systems.

1.5.3.5. Review and comment on product data and shop drawing submittals and coordination drawings applicable to systems being commissioned.

1.5.3.6. Following submittal review and approvals by the A/E team, review the sequences of operation and coordinate with the Contractor and A/E Team in order to prepare the Functional Performance Test Procedures and Integrated Systems Test procedures. Submit to the Owner and Contractor for review and comment prior to facilitating FPTs and ISTs on the project.

1.5.3.7. Upon written notice that equipment or systems are ready for initial energizing or start-up, review the progress of the System Verification Checklist(s) for the respective systems and components and ensure that all requirements have been completed by the Contractor to permit energizing or start-up in accordance with the project documents; CxA shall issue written notice to the Owner and Contractor that equipment is ready to energize or start-up. CxA will witness and ensure proper documentation is provided by the Contractor for major equipment energizing and start-ups as executed by the Contractor with appropriate notice as indicated herein.

1.5.3.8. Witness, verify, and document results of Functional Performance Tests and Integrated Systems Tests.

1.5.3.9. Coordinate resolution of deficiencies identified during site observations, equipment energizing or start-up, Functional Performance Testing, Integrated Systems Testing, Deferred Testing, and during the warranty period.

1.5.3.10. Review the Operating and Maintenance (O&M) documents to ensure that as-built information and correct data is included prior to the Owner Training sessions; review final O&M submittal to ensure compliance with the requirements in the project documents and provide written comments to the Owner.

1.5.3.11. Review the Contractor's Training Plan and individual training agendas for compliance with the requirements in the project documents. Recommend acceptance to the Owner prior to the Contractor scheduling training sessions with the Owner. Review the attendance and content of the training sessions to ensure the requirements of the project documents are completed. Conduct a survey of the Owner's personnel to evaluate the effectiveness of the Owner Training.

1.5.3.12. Compile the Final Commissioning Process Report and submit to the Owner for review and approval.

1.5.4. Architect/Engineer's (A/E) Roles and Responsibilities:

1.5.4.1. Specify control sequences of operation within the Contract Documents that comply with the OPR and BOD.

1.5.4.2. Incorporate Commissioning requirements into the Contract Documents if requested by the Owner.

1.5.4.3. Attend Commissioning Team meetings.

1.5.4.4. Review the Commissioning Plan, System Verification Checklist templates, Functional Performance Test Procedures, Integrated Systems Test Procedures, Deferred Testing Plans, and other Commissioning documents as required by the Owner or the Contract Documents.

1.5.4.5. Review Contractor's Training Plan and provide comments to the Owner.

1.5.4.6. Approve technical requirements for correction of Deficiencies identified during Commissioning, Deferred Tests, and during the warranty period.

1.5.4.7. Review Operating and Maintenance Manuals and provide comments to the Owner.

1.5.5. Contractor's Roles and Responsibilities:

1.5.5.1. Contractor shall review and provide comments on documents produced by the Commissioning Authority, and shall accept the Commissioning Plan, System Verification Checklists, Functional Performance Test Procedures, and Integrated System Test Procedures as approved by the Owner.

1.5.5.2. Provide an individual, subject to the Owner's approval, experienced in construction and Commissioning of building systems to organize, schedule, conduct, and document the Contractor's responsibilities in the Commissioning process. The Contractor shall assign this individual to act as the Contractor's Commissioning Coordinator. The Contractor's Commissioning Coordinator may have additional duties such as MEP Coordinator, but not as Project Manager or Superintendent. Submit qualifications demonstrating the Commissioning Coordinator's technical expertise and experience to the Owner for approval. In the event that Contractor chooses to subcontract its Commissioning obligations, then Contractor must submit the subcontractor's qualifications and personnel to Owner for Owner's approval.

1.5.5.3. Furnish and install systems that meet all requirements of the Contract Documents.

1.5.5.4. Ensure that Commissioning Process activities are incorporated into the Master Project Schedule. The Contractor shall coordinate with the CxA and the Owner to determine the required activities, durations and predecessors.

1.5.5.5. Submit inspection requests, start-up requests and all supporting documentation in accordance with the Contract Documents, General Conditions, and Commissioning Plan.

1.5.5.6. Cooperate with Owner's representative(s), provide access to work and provide adequate labor, resources, and time for Commissioning.

1.5.5.7. Furnish copies of all shop drawings and submittals, manufacturers' literature, maintenance information, and any other information required for the Commissioning process. Contractor must submit to the Owner installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by the factory or field technicians. This requirement does not supersede any additional requirements contained in the Contract Documents.

1.5.5.8. Schedule and conduct pre-installation meetings and pre-commissioning meetings with subcontractors and equipment suppliers related to Commissioning. Contractor must invite Architect/Engineer, Owner and CxA to attend the pre-installation meetings and pre-commissioning meetings.

1.5.5.9. Provide qualified personnel, including subcontractors as required, to fully perform the testing and operational demonstrations required by the Contract Documents and the Commissioning Plan, including any Deferred Testing or re-testing related to warranty work.

1.5.5.10. Correct deficiencies identified during any stage of the Commissioning process.

1.5.5.11. Coordinate with the CxA to develop the Training Plan and submit to the Owner for approval. Provide training to the Owner's personnel in accordance with the Contract Documents and the approved Training Plan. Coordinate with the Owner to schedule training sessions and coordinate subcontractor/vendor participation in all training sessions.

1.5.5.12. Perform Deferred Testing and make necessary amendments to Operating and Maintenance Manuals and as-built drawings for applicable issues identified during the Deferred Testing.

1.5.5.13. Perform system maintenance during construction as specified and recommended by the Owner and send the maintenance records to the Owner for Record.

1.5.5.14. Document the equipment as it arrives onsite to ensure that the submitted and received equipment is correct as it arrives onsite, including the completion of the system verification sections pertaining to the procurement process.

1.6. SYSTEMS TO BE COMMISSIONED

1.6.1. The following systems shall be commissioned according to the process defined in this Section:

1.6.1.1. Major HVAC Systems (100% including but not limited to the list below)
- 1.6.1.1.1 Air Handling Units
- 1.6.1.1.2 Fan Coil Units
- 1.6.1.1.3 Exhaust Fans
- 1.6.1.1.4 Supply Fans
- 1.6.1.1.5 Pumps
- 1.6.1.1.6 Chillers
- 1.6.1.1.7 Boilers

1.6.1.2. Terminal Units (10% Sampling)

1.6.1.3. Building Automation System

1.6.1.4. Lighting Controls - Occupancy Sensors (25% greater than 25 sensors installed, 100% less than 25 sensors installed)

1.6.1.5. Lighting - Daylight Controls (100%)

1.6.1.6. Lighting - Time Switch Controls (100%)

1.6.1.7. Normal and Emergency Power Systems

PART 2 - PRODUCTS

2.1. COMMISSIONING PLAN

2.1.1. Document developed by the CxA that provides the structure, schedule, and coordination plan for the Commissioning Process from the Pre-construction phase through the Occupancy Phase. The Commissioning Plan shall describe the project and systems to be commissioned, Commissioning Process activities and deliverables, procedures to follow throughout the process, specific roles and responsibilities for each participant, and general description of testing and verification methods.

2.1.2. The Commissioning Plan shall comply with the Owner’s Project Requirements (OPR).

2.1.3. The Commissioning Team shall review the Commissioning Plan prior to the Pre-Commissioning Meeting and submit written comments or questions to the CxA to be addressed in the meeting.

2.1.4. Following the Pre-Commissioning meeting, the CxA shall incorporate all changes discussed and agreed upon in the Pre-Commissioning meeting and submit the Final Commissioning Plan to the Commissioning Team for approval and acceptance.

2.1.5. If changes to the Commissioning Plan are needed during the Commissioning Process, the CxA shall edit the plan and distribute to the Commissioning Team for approval and acceptance.

2.1.6. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor. The Contractor shall ensure that all sub-contractors and vendors agree and accept the Commissioning Plan.

2.2. SYSTEM VERIFICATION CHECKLISTS

2.2.1. System Verification Checklists (SVCs) are important to ensure that the equipment and systems are connected and operational and that Functional Performance Testing proceeds without unnecessary delays. These checklists document the inspections and procedures necessary to take a piece of equipment from a static state into an operating state. These checklists augment the manufacturer's start-up checklists to provide a complete document from procurement to the start of Functional Performance Testing when combined.

2.2.2. The CxA shall develop the System Verification Checklist templates for review by the Cx Team. The Contractor, appropriate Subcontractors and Vendors shall support the CxA in development of SVCs for each system and components by providing any necessary supporting documentation as requested by the CxA and reviewing and commenting on the checklist templates in accordance with the Project Specifications and the Commissioning Plan.

2.2.3. Once the checklist templates are reviewed and accepted, the CxA will produce checklists for all equipment and components to be commissioned on the project utilizing an electronic commissioning database that is accessible via web portal or local field tool (i.e., iPad, tablet, laptop, etc.).

2.2.4. The CxA shall provide login access and training to the Contractor and other members of the Cx Team in the use of the electronic commissioning database.

2.2.5. The Contractor shall be responsible for completing the required sections of the System Verification Checklists utilizing the electronic commissioning database and providing all supporting documentation via electronic transmittal to the CxA. Additional requirements for completion of the SVCs are included in this section and other technical sections of the Specifications.

2.2.6. Once equipment arrives on the project site, the Contractor or sub-contractors shall begin completing the individual checklists and continue throughout the installation process. The checklists are meant to be progressive and a tool for tracking progress.

2.2.7. Once the SVCs are electronically completed, the CxA will review and approve the checklists and supporting documentation and compile the information to include in the Final Commissioning Process Report.

2.3. FUNCTIONAL PERFORMANCE TESTING PROCEDURES:

2.3.1. The purpose of the Functional Performance Testing Procedures is to verify and document that the equipment and systems on the project individually perform in accordance with the requirements in the Contract Documents and meet the Owner's Project Requirements.

2.3.2. The CxA shall develop specific script-type test procedures to verify and document proper operation of each piece of equipment and system. The Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, O&M information, and sequences of operation. Once developed, the CxA will issue to the Cx Team for review and comment.

2.3.3. The Commissioning Team shall review the Functional Performance Test procedures and submit written comments or questions to the CxA. The Contractor shall ensure that the sub-contractors and any vendors that would be involved with Functional Performance Testing review the procedures and provide comments.

2.3.4. The CxA will coordinate with the Cx Team to address any comments and produce the final FPT procedures for acceptance by the Cx Team. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor.

2.3.5. The Contractor shall utilize the FPT procedures for any pre-testing activities prior to Functional Performance Testing.

2.4. INTEGRATED SYSTEMS TESTING PROCEDURES:

2.4.1. The purpose of the Integrated Systems Testing Procedures is to verify and document that all the integrated equipment and systems on the project perform together in accordance with the requirements in the Contract Documents and meet the Owner's Project Requirements.

2.4.2. The CxA shall develop specific script-type test procedures to verify and document proper operation of the integrated systems throughout the facility. The Contractor shall provide any supporting information to the CxA that may be needed including but not limited to product submittals, O&M information, and sequences of operation. Once developed, the CxA will issue to the Cx Team for review and comment.

2.4.3. The Commissioning Team shall review the Integrated Systems Testing procedures and submit written comments or questions to the CxA. The Contractor shall ensure that the sub-contractors and any vendors that would be involved with Integrated Systems Testing review the procedures and provide comments.

2.4.4. The CxA shall coordinate with the Cx Team to address any comments and produce the final IST procedures for acceptance by the Cx Team. The Contractor's acceptance shall constitute acceptance of all parties sub-contracted to the Contractor.

2.4.5. The CxA shall also develop the IST personnel matrix that will be utilized to track the individual testing teams involved with the IST. The CxA will distribute the matrix to the Cx Team so that the Contractor and Owner can assign the appropriate personnel to the appropriate teams.

2.4.6. The CxA shall also host a coordination meeting prior to the IST to review the IST procedures, complete any final coordination, review safety procedures, and answer any questions.

2.4.7. The CxA estimates there will be two Integrated Systems Tests on the project. The first will test the Data Center systems separately and the second will test the entire facility. Requirements of the testing are included in the respective technical sections of the Project Specifications.

2.4.8. The IST procedures shall be utilized by the Contractor for any pre-testing activities prior to official Integrated Systems Testing.

2.5. TRAINING PLAN

2.5.1. Contractor, in coordination with Owner and CxA, shall develop the Training Plan with project specific requirements for Owner Training, after reviewing the different systems to be installed and commissioned. The purpose of the Training Plan is to specifically communicate the required content and training durations required by the Owner based upon the type of equipment and the Owner's past experience.

2.5.2. The Contractor shall review all of the individual technical sections of this specification for specific training requirements.

2.5.3. The Contractor shall coordinate with the Owner to ensure that the proposed training requirements meet the Owner's needs and expectations.

2.5.4. The Contractor shall coordinate with the sub-contractors and vendors to ensure the Owner Training requirements can be achieved and gather any additional information or recommendations.

2.5.5. Any changes to the training requirements in this specification must follow contractual protocols.

2.5.6. The Training Plan shall include a list of systems and equipment for which training will be provided according to the three-tiered training approach outlined in the project specifications.

2.5.7. All training sessions shall have a syllabus indicating the following as a minimum in addition to any other specification requirements:

2.5.7.1. Session Objectives

2.5.7.2. Proposed Instructor(s)

2.5.7.3. Instructor Qualifications

2.5.7.4. Training Materials that will be provided

2.5.7.5. Location and durations of the various parts of the training session (i.e., Classroom, On-site, etc.)

2.5.7.6. Applicable specification sections and O&M Manual sections

2.5.7.7. Detailed outline of training session content

2.5.8. The Contractor shall coordinate with the CxA to organize the systemic training sessions comparable to the organization of the Systems Manual.

2.5.9. Owner training must be completed prior to the contractor obtaining substantial completion by the Owner.

2.6. FINAL COMMISSIONING PROCESS REPORT

2.6.1. The CxA shall prepare the Final Commissioning Process Report that will include the following:

2.6.1.1. Executive Summary

2.6.1.2. Participants and Roles

2.6.1.3. Brief building description

2.6.1.4. Overview of commissioning and testing scope

2.6.1.5. General description of testing and verification methods

2.6.1.6. Appendices with supporting information, issues log, and communications

2.6.2. The Contractor shall coordinate with the CxA to provide any additional information that may be needed to complete the Final Commissioning Process Report.

2.6.3. The Contractor shall resolve any outstanding commissioning items prior to the CxA preparing the final commissioning report.

2.6.4. The CxA shall issue the Final Commissioning Process Report to the Cx Team for review. The Owner shall approve the Final Commissioning Process report after any comments or discrepancies are resolved by the CxA.

PART 3- EXECUTION

3.1. PROJECT SCHEDULE

3.1.1. The Contractor shall integrate all Commissioning activities into the detailed Project Schedule. All parties will address scheduling problems and make necessary notifications in a timely manner to expedite the Commissioning Process.

3.2. COMMISSIONING TEAM MEETINGS

3.2.1. Upon obtaining Owner's approval of the Commissioning Plan, the CxA shall coordinate with the Cx Team to schedule, plan, and conduct a Pre-Commissioning Meeting with all parties involved in the Commissioning process. This meeting should include the major subcontractors, specialty manufacturers/suppliers, Architect/Engineer, Test, Adjust, and Balance (TAB) Firm, Electrical Testing Agency, and Owner's representatives as participants.

3.2.2. Contractor shall prepare for the Pre-Commissioning Meeting by supplying the following documents created by the CxA to all applicable sub-contractors and vendors: Commissioning Plan, Example System Verification Checklists, Example Functional Performance Test Procedures and Example Integrated Systems Test Procedures.

3.2.3. The CxA shall conduct the Pre-Commissioning Meeting and review all aspects of the Commissioning Plan and applicable specifications.

3.2.4. The Commissioning Plan shall be reviewed with all attendees and the scope of work discussed. Contractor should be prepared to distribute copies of the pertinent sections to the various subcontractors involved in the Commissioning process.

3.2.5. The final outcome of the meeting shall be an understanding of the commissioning process, roles and responsibilities, and consensus acceptance of the Commissioning Plan by the Cx Team.

3.2.6. The Contractor may request additional meetings with the CxA and individual sub-contractors to clarify roles, responsibilities and procedures as needed.

3.3. TEST EQUIPMENT

3.3.1. Contractor shall provide all specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment.

3.3.2. All specialized tools, test equipment and instruments required to execute start-up, checkout, and testing of equipment shall be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated test equipment within the previous twelve (12) months. Calibration shall be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and

whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

3.4. REPORTING

3.4.1. Beginning at the procurement stage for the equipment included in the Cx scope, the Contractor shall communicate at least monthly with all members of the Commissioning Team, keeping them apprised of construction progress and scheduling changes.

3.4.2. Contractor shall submit Deficiency reports to the Owner within five (5) days of the deficiency occurrence. This includes responses to items noted by the Commissioning Authority.

3.5. DEFICIENCY RESOLUTION

3.5.1. The CxA shall document any issues noted during observation or testing activities in the Commissioning Issues Log (CxIL). The CxIL shall be distributed electronically to the Cx Team at regular intervals.

3.5.2. The Contractor shall respond in writing to the CxA within 10 days to all new CxIL items regardless of the disposition. This response does not constitute a request for re-verification, only an acknowledgement of the outstanding item. The Contractor should utilize CxIL responses to update the Cx Team on the progress of deficiency resolution.

3.5.3. The Contractor shall respond to the CxA and the Owner indicating CxIL items that are completed and ready for the CxA to verify completion.

3.5.4. If any item indicated complete by the Contractor is found to be incomplete by the CxA upon re-verification the Contractor is responsible for all costs and additional compensation resulting from incomplete Cx Issues Log items.

3.6. REQUEST FOR ENERGIZING / START-UP OF EQUIPMENT

3.6.1. The Owner and/or Owner's representative may install lockout devices on equipment in addition to the Contractor's lockout / tagout devices once permanent power is connected to the facility. This lock would be removed once the proper start-up notification is received by the Owner and/or CxA, and the CxA has reviewed the appropriate SVCs and supporting documentation to verify the equipment is ready for energizing and/or start-up.

3.6.2. These requirements do not supersede any additional requirements noted elsewhere in the Contract Documents or as required by applicable code authorities.

3.6.3. Contractor shall notify Owner and CxA in writing to request initial energizing and/or start-up of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled start-up.

3.6.4. Contractor shall complete the applicable sections of the System Verification Checklist(s) evidencing the Contractor's thorough inspection of the system and readiness for start-up activities as required by the Project Documents and the Commissioning Plan. Contractor shall submit required supporting documentation to the Owner and/or CxA, including but not limited to, factory testing reports, alignment reports, electrical testing reports and any other documentation required by the Project Documents prior to energizing and/or start-up.

3.6.5. The CxA shall review the SVCs and supporting documentation within the 72 hour notice period and confirm in writing that the systems and equipment are approved to proceed with energizing and start-up.

3.6.6. The CxA and/or owner may witness equipment energizing and/or start-up at the scheduled time, but witness is not required, unless noted elsewhere in the Specifications, as long as written approval is received as noted herein.

3.6.7. Contractor shall perform Start-up under supervision of the responsible manufacturer's representative in accordance with manufacturer's instructions and Project Document requirements.

3.6.8. Contractor shall complete all required factory start-up documentation and applicable items in the System Verification Checklists, prior to startup, to ensure compliance with the requirements in the Project Documents.

3.7. OPERATIONAL TESTING

3.7.1. Once the appropriate start-up activities are completed, the Contractor shall complete all necessary operational testing requirements included in the Project Documents prior to Functional Performance Testing. Specific requirements for systems and equipment are included in other technical sections of the Specifications.

3.7.2. Contractor shall complete all operational testing items in the System Verification Checklist and submit all supporting documentation to the Owner and/or CxA for review.

3.7.3. Contractor and manufacturer's representatives shall supervise and coordinate adjustments and balancing of all devices and systems for proper operation prior to requesting a Functional Performance Test(s).

3.7.4. Contractor shall clearly list outstanding items or System Verification Checklist items not completed successfully. Contractor shall obtain from Subcontractor or vendor completed forms documenting any outstanding deficiencies within five (5) days of completion of energizing and/or start-up activities.

3.7.5. Contractor shall review completed deficiencies to determine if outstanding items prevent execution of the Functional Performance Tests and shall issue any necessary responses to the Owner and/or Commissioning Authority.

3.7.6. Contractor shall notify Owner and CxA in writing to request Functional Performance Testing of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled activities. Owner may require Contractor to reschedule Functional Performance Testing to ensure availability of Owner’s representative(s) as needed.

3.7.7. The CxA shall review the SVCs and supporting documentation within the 72 hour notice period and confirm in writing that the systems and equipment are approved to proceed with Functional Performance Testing.

3.7.8. If any item indicated complete by the Contractor is found to be incomplete by the CxA upon re-verification the Contractor is responsible for all costs and additional compensation resulting from incomplete System Verification Checklist items.

3.8. CONTROL POINT AND SENSOR CALIBRATION VERIFICATION

3.8.1. Automation systems installed on the project must be fully verified for point integrity and sensor calibration prior to Functional Performance Testing. Additional requirements for this verification are listed in other technical sections of the Specifications.

3.8.2. The Contractor shall verify these points according to the requirements in the project documents as part of start-up and operational testing of systems.

3.8.3. The TAB contractor shall independently verify each sensor and point and document the results to be included in the Final TAB Report.

3.8.4. The CxA will witness, at their discretion, this verification and/or independently verify and document the results to be included in the Final Commissioning Process Report.

3.8.5. These activities must be completed prior to the Contractor requesting Functional Performance Testing as indicated herein.

3.9. FUNCTIONAL PERFORMANCE TESTING

3.9.1. The objective of Functional Performance Testing is to demonstrate that each system operates according to the requirements in the Project Documents and meets the OPR and BOD.

3.9.2. Contractor shall operate, or cause to be operated, each system, device, or equipment item, both intermittently and continuously, for a duration period as indicated in the Specification Section(s) for each item and/or in accordance with the Project Documents, the Commissioning Plan and applicable Functional Performance Testing procedures.

3.9.3. Contractor shall operate each component device and each building system to the full extent of its capability, from minimum to maximum, and under automatic control and manual control.

3.9.4. The CxA and members of the Cx Team, including the Owner's personnel, may observe Functional Performance Testing of equipment components and systems. The CxA shall facilitate the Functional Performance Testing activities according to the accepted FPT procedures and record the results of all testing activities.

3.9.5. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, the owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by the Contractor. The Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled Functional Performance Testing.

3.9.6. All Functional Performance Testing of Integrated Systems must be completed in accordance with the Project Documents and the Commissioning Plan prior to the Contractor scheduling the Integrated Systems Testing activities.

3.10. INTEGRATED SYSTEMS TESTING

3.10.1. The objective of Integrated Systems Testing is to demonstrate that each integrated system operates jointly and/or independently of other systems according to the requirements in the Contract Documents.

3.10.2. Contractor shall operate each system, jointly and independently of other systems, through selected modes of operation (fire alarm integration with HVAC, emergency power modes, equipment failures among related systems, etc.) according to the accepted Integrated Systems Testing procedures developed by the CxA. The CxA shall facilitate and document the testing, organizing the appropriate testing teams and providing sufficient instruction to all participants to conduct efficient and effective testing activities.

3.10.3. Integrated Systems Testing typically involves multiple teams with representation from the CxA, Owner, and Contractor. The Contractor shall provide any needed communication equipment (i.e.,

radios) or make available any centralized intercom or paging system for communication with all testing groups.

3.10.4. The Contractor shall provide no less than 7 days (not including weekends or holidays) notice when requesting to conduct the Integrated Systems Testing. All personnel must be assigned to the Personnel Matrix by the CxA and a coordination meeting held within the 7 day period as prescribed elsewhere in this section.

3.10.5. Contractor conducts Integrated Systems Testing after all applicable Functional Performance Testing is satisfactorily completed and approved by the Owner and/or CxA.

3.10.6. The CxA shall record any deficiencies noted during the testing in the CxIL. If significant deficiencies exist, the owner and/or CxA may request that the testing activities be terminated and re-scheduled after proper verification by the Contractor. The Contractor is responsible for all costs and additional compensation resulting from deficiencies and incomplete systems noted during scheduled Integrated Systems Testing.

3.11. DEMONSTRATION AND OWNER TRAINING

3.11.1. The Contractor, in coordination with Owner and CxA, shall develop the Training Plan with project specific requirements for Owner Training as required throughout various sections of the Project Specifications.

3.11.2. The specific requirements for scheduling and conducting the Owner Training are included in other sections of this Specification.

3.11.3. Owner Training activities shall not occur until the Training Plan is approved by the Owner and the Contractor has submitted all O&M information for review and use during the training sessions.

3.11.4. The Contractor shall notify the CxA of all training sessions. The Contractor shall record attendance of the training sessions and the Owner shall ensure the appropriate personnel are in attendance.

3.11.5. The CxA shall ensure the content of the Owner Training sessions meets the requirements in the Project Documents.

3.11.6. The CxA may conduct surveys of the Owner's personnel to gauge the effectiveness of the Owner training sessions. If unfavorable surveys are received by the Owner's personnel indicating unsatisfactory training, the Owner reserves the right to require the Contractor to re-train in those specific areas of non-conformance until the requirements in the Project Documents are satisfactorily completed.

3.11.7. Owner training must be completed prior to the contractor obtaining substantial completion by the Owner.

3.12. DEFERRED / SEASONAL TESTING

3.12.1. All Construction phase requirements of the Commissioning Process must be completed prior to Substantial Completion or as indicated elsewhere in this Specification.

3.12.2. If any testing or other requirements cannot be completed prior to Substantial Completion due to the building structure, required occupancy condition, or other condition, performance of such test may be delayed to later in the warranty period, upon approval of the Owner. Contractor shall reschedule testing according to the protocols described in this section and any other operational protocols prescribed by the Owner.

3.12.3. Contractor shall complete all outstanding commissioning requirements as part of this Contract during the warranty period. Contractor shall schedule all activities with Owner and/or CxA.

The CxA shall document any deferred testing activities and ensure the appropriate commissioning documents are updated. The Contractor shall provide any additional documentation needed by the CxA to complete these requirements.

END OF SECTION 01 45 23

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Requirements for temporary utilities, support facilities, and security and protection facilities, including but not limited to:
1. Water service and distribution.
2. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.
3. Heating and cooling facilities.
4. Ventilation.
5. Electric power service.
6. Lighting.
7. Telephone service.
8. Waste disposal facilities.
9. Field office.
10. Storage and fabrication sheds.
11. Lifts and hoists.
12. Construction aids and miscellaneous services and facilities.
13. Environmental protection.
14. Pest control.
15. Enclosure fence.
16. Security enclosure and lockup.
17. Barricades, warning signs, and lights.
18. Temporary partitions.
19. Fire protection.
20. Accessories necessary for a complete installation.

1.3 USE CHARGES

A. Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service: Pay sewer service use charges for water used and sewer usage by all entities for construction operations.

C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Moisture Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged work.
   3. Indicate sequencing of Work that requires water, such as sprayed fire resistive materials, plastering, and tile grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust and HVAC Control Plan: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. HVAC system isolation schematic drawing.
   2. Location of proposed air-filtration system discharge.
   3. Waste handling procedures.
   4. Other dust control measures.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines (ADAAG), ICC/ANSI A117.1, and Texas Accessibility Standards (TAS) 2012.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E 84.

D. Dust Control Adhesive Surface Walk off Mats: Provide mats minimum 36 inches by 60 inches (914 mm by 1624 mm).

E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively.

F. Lumber and Plywood: Comply with requirements in Section 06 10 53.

G. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; Type X or Type C panels with tapered edges. Comply with Section 09 29 00.

H. Paint: Comply with requirements in Section 09 90 00.

I. Tarpaulins: Fire resistive labeled with flame-spread rating of 15 or less.

J. Water: Potable.

2.2 TEMPORARY FACILITIES

A. Contractor's Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Provide elevated, stabilized concrete walkway from parking area to field offices.

B. Architect's Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Provide elevated, stabilized concrete walkway from parking area to field offices.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Air Filtration Units: HEPA primary and secondary filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

C. Drinking Water: Containerized, tap dispenser, bottled water drinking water units, including paper cup supply. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 degrees F to 55 degrees F (7.2 degrees C to 12.7 degrees C).

D. Electrical Outlets: Properly configured, NEMA polarized outlets to prevent insertion of 110V to 120V plugs into higher voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

F. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control.
   1. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

2. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of **8** at each return air grille in system and remove at end of construction. Clean HVAC system as required in Section 01 77 00 and install new filter with MERV 11 or greater.

G. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate facilities where they will serve project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Section 01 10 00.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. Install temporary service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
2. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing Work, isolate the HVAC system in area where Work is to be performed according to coordination drawings.
a. Disconnect supply and return ductwork in Work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within Work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust producing equipment. Isolate limited Work within occupied areas using portable dust containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service underground unless otherwise indicated.
1. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
a. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length voltage ratio.
b. Provide warning signs at power outlets other than 110 to 120 V.
c. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or traffic areas.
d. Provide metal conduit enclosures or boxes for wiring devices.
e. Provide 4 gang outlets, spaced so 100 foot (30 m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

J. Telephone Service: Provide temporary telephone service in common use facilities for use by construction personnel. Install one telephone line(s) for each field office.

1. Provide dedicated telephone line for each facsimile machine in each field office.
2. At each telephone, post a list of important telephone numbers.
a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service: Provide a desktop computer and printer/scanner in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.
   1. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall.
   2. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
   3. Backup: External hard drive, minimum 1 terabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
   1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
   2. Prepare subgrade and install subbase and base for temporary roads and paved areas in according to specifications.
   3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
   4. Delay installation of final course of permanent pavement until immediately before Substantial Completion.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.

   3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Use of elevators is not permitted.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities to the satisfaction of Owner and Architect.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree or plant protection zones.
   2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin. provide site enclosure fence to prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each Work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor to ceiling dustproof partitions to limit dust and dirt migration and to separate occupied areas occupied from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire retardant treated plywood on construction operations side.
   2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood. Do not apply tape to finish floor surfaces.
      a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.

   3. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
   4. Insulate partitions to control noise transmission to occupied areas.
   5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   6. Protect air handling equipment.
   7. Provide walk off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.

4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform Work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Condition Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits and moisture control.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum based products, which become wet during the course of construction and remain wet for 48 hours are considered defective and are to be removed and replaced.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24 hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion unless otherwise required and approved by Owner and Architect.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and

aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00"

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for selection of products, including but not limited to:
   1. Product delivery, storage, and handling.
   2. Manufacturers' written warranties on products.
   3. Special warranties.
   4. Comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis of Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words *basis of design product*, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the specified requirements.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 01 33 00.

b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal: Comply with requirements in Section 01 33 00. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term “as selected”, Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.

C. Visual Matching Specification: Where Specifications require “*match Architect's sample”*, provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 25 00 for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "*selected by Architect"* or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 60 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Final completion procedures.
   2. Warranties.
   3. Closeout documents
   4. Final cleaning.
   5. Repair of the Work.

B. Failure to complete close-out requirements within 90 days after substantial completion may result in liquidated damages being assessed to the Contractor. Refer to Conditions of the Contract for additional requirements and liquidated damages.

1.3 SUBMITTALS

A. Certified List of Incomplete Items (Punchlist): Final submittal at Final Completion.

B. Certificates of Release: From authorities having jurisdiction.

C. Certificate of Insurance: For continuing coverage.

D. Field Report: For pest control inspection.

E. Record Documents: Per requirements of Section 01 78 39.

F. Warranties: Per requirements of paragraph 1.6.

G. Closeout Documents: Per requirements of paragraph 1.7.

H. List of Extra Materials: Per requirements of paragraph 1.7.

1.4 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
   1. Close-out Documents: Provide bound closeout documents as described in paragraph 1.7. Refer to Document 00 73 00 - Supplementary Conditions to the General Conditions of the Contract for Construction, Paragraph 9.10 for additional information.
   2. Record Drawings: Provide record documents in accordance with 01 78 39.
   3. Extra Stock: Transmit extra stock as required in accordance with Division 01 and individual specification sections.
   4. Submit a final Application for Payment in accordance with the Contract Documents.

5. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
6. Certified List of deficiencies from the Commissioning Agent and Test, Adjust and Balance Consultants: Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
7. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
8. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.

4. Submit list of incomplete items in a PDF electronic file. Architect will return annotated file.

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty. All warranties submitted must comply with the construction documents and be issued in the Owner’s Name.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. General Contractor's Warranty: Submit on company letterhead. This Warranty shall state all sections of Work performed by General Contractor’s own forces, and warranty period for each section of Work.

D. Subcontractors' Warranties: notarized, and submitted on attached **Close-out Form "D"**. This Warranty shall state all sections of Work performed by the subcontractor and warranty period.

E. Manufacturer and Supplier Warranties: Warranties should be issued in accordance with Contract requirements and in the Owner's name. All manufacturer warranties are effective as of the date of substantial completion, not at the date of start-up.

F. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual. Bind warranties and bonds in heavy duty, three ring, loose leaf binders, thickness necessary to accommodate contents, and sized to receive 8-1/2 inch by 11 inch (215 mm by 280 mm) paper.

G. Provide heavy paper dividers with plastic covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

H. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

I. Warranty Electronic File: In addition to the Warranty Binder, scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

J. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.7 CLOSEOUT DOCUMENTS

A. Coordinate the following items with the requirements of Document 00 73 CB - Supplementary Conditions to the General Conditions of the Contract for Construction.

B. Prepare 3-ring D-slant binder cover and spline with printed title "CLOSEOUT DOCUMENTS", title of project, and subject matter of binder when multiple binders are required. Submit one (1) original and two (2) copies.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. The close-out documents shall be neatly organized and easily useable as determined by the Architect and Owner. Separate Close-out Documents binders from Operations and Maintenance Manuals required under Section 01 77 22. Documents identified as "affidavit" shall be notarized.

E. Contents: Prepare Table of Contents for each volume, with each item description identified, typed on white paper, in five (5) parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers. All General Contractor's vendors/suppliers and subcontractors that provided materials or performed any work related to this project must be listed on this form. Submit Final List of Subcontractors.
   2. Part 2: Closeout Documents and Affidavits, include the following:
      a. AIA G707 - Consent of Surety to Final Payment;
      b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims;
      c. AIA G706A - Contractor's Affidavit of Release of Liens;

d. Subcontractor's Release of Lien: Include contractors', subcontractors' and direct material and equipment suppliers' separate final releases. Submit on attached **Close-out Form "A"** - Affidavit of Subcontractor's Release of Lien.

3. Part 3: Project documents and certificates, including the following:
   a. Copy of Certificate of Substantial Completion (AIA G704);
   b. Copy of All Permits;
   c. Copy of Final Utility Bill or letter of transfer;
   d. Copy of Certificate of Occupancy;
   e. Certification of Project Compliance: Submit on attached **Close-out Form "B"**. Owner and Architect will initiate form and forward to Contractor for signature once Substantial Completion is established;
   f. Hazardous Material Certificate: Submit on attached **Close-out Form "C"**. Affidavits from Contractor, Subcontractors and General Contractor's vendors or suppliers stating that no hazardous materials/products have been used or installed in this project.
4. Part 4: Receipts:
   a. Extra Stock: Provide original receipts for delivery of "Extra Stock" items as described below, (if applicable). Receipts must be signed by an authorized Owner's representative;

F. In addition to the three (3) required close-out binders listed above, provide Architect with one (1) separate binder for their records containing the following:
   1. Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers;
   2. all MSDS sheets for the project;
   3. all warranties from Contractor, subcontractors, direct suppliers, and manufacturers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activites include but are not limited to:
      a. Clean site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00. Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    a. Do not paint over *UL* and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the _____ of _____, the subcontractor who supplied, installed, and /or erected the work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

   Project: <PROJECT NAME>
   Owner: Clear Creek Independent School District
   Architect: <ARCHITECT NAME>
   Work Performed: <SUMMARY OF PRIMARY SCOPE OF WORK>

2. That all work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.

3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

_____
Name of Subcontractor

_____
(By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

(Seal)

_____
(Notary Public Signature)

CLOSE OUT FORM "B"

CERTIFICATION OF PROJECT COMPLIANCE

Completion of this form is required under the provisions of §61.1036(c)(3)(F) TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION

DISTRICT:

Facility:

ARCHITECT/ENGINEER:

Address:

CONTRACTOR/CM:

City:

CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: **BY:** **DATE:**

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: **BY:** **DATE:**

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM: **BY:** **DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: **BY:** **DATE:**

INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM

Section 1. Identify the following:
- – name and address of the school facility
- – name of the school district
- – the Architect/Engineer and Contractor
- – the date of execution of the construction contract
- – the date that the school district authorized the superintendent to hire an architect/engineer
- – scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.1033 or §61.1036, School Facilities Standards) and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

CLOSE-OUT FORM "C"

SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

THE STATE OF _____

COUNTY OF _____

PROJECT: <PROJECT NAME>

OWNER: Clear Creek Independent School District

ARCHITECT: <ARCHITECT NAME>

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says that he / she is the _____ of _____,the subcontractor / supplier who constructed or provided the section(s) of work referenced above, and that he / she is duly authorized to certify to the best of his / her information, knowledge, and belief no asbestos, lead or PCB containing products have been incorporated into the project.

_____
Name of Subcontractor / Supplier

_____
(By) (Title)

_____

JURAT

THE STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

_____
(Seal) (Notary Public Signature)

CLOSE-OUT FORM "D"

SUBCONTRACTOR WARRANTY

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the Subcontractor (or the _____of_____ the subcontractor) who supplied, installed, and / or erected the work described below, and that, he / she is duly authorized to make this Subcontractor Warranty:

   Project: <PROJECT NAME>
   Owner: Clear Creek Independent School District Architect: <ARCHITECT NAME>
   Work Performed: All work performed under contract for this project

2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Subcontractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.

4. The Subcontractor warrants the work performed for a period of _____ months from the date of Substantial Completion, except as follows:_____
   _____

_____
Name of Subcontractor

_____
(By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20____.

_____
(Seal) (Notary Public Signature)

SECTION 01 77 22 – SUBSTANTIAL COMPLETION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.

1.3 SUBMITTALS

A. Contractor's List of Incomplete Items (Punchlist): Initial submittal at Substantial Completion.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Minimum of 10 days prior to requesting an inspection for determining date of Substantial Completion. List items that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from all (i.e. city, county, authorities) authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
      a. List of Extra Materials: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
   5. Submit test/adjust/balance and commissioning records from Owner vendor.
   6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: A minimum of 10 days prior to requesting inspection for determining date of Substantial Completion, submit list items that are incomplete at time of request. Refer to Section 00 70 CB Supplementary Conditions to the Contract for Construction.
   1. All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed,

and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

2. All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.
3. All fire alarm system components must be completed and demonstrated to the Owner.
4. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
5. All exterior clean-up and landscaping must be complete.
6. All final interior clean-up must be complete.
7. Complete startup and testing of systems and equipment.
8. All HVAC air and water balancing must be complete.
9. All required commissioning must be complete.
10. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
11. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
12. All final lockset cores must be installed and all final Owner directed keying completed.
13. All room plaques and exterior signage must be completed.
14. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
15. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
16. Perform preventive maintenance on equipment used prior to Substantial Completion.
17. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems in accordance with Sections 01 78 23 and 01 79 00. Submit demonstration and training video recordings as required.
18. Advise Owner of changeover in utilities.
19. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
20. Terminate and remove temporary facilities from site, including mockups, construction tools, and similar elements and restore or configure area to required or original condition.
21. Complete final cleaning requirements, including touchup painting.
22. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
23. Advise Owner of pending insurance changeover requirements.
24. Comply with conditional lien regulations.

D. Inspection: Submit written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for final completion.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activites include but are not limited to:
    a. Clean site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
        1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
    p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00. Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00.

END OF SECTION 01 77 22

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory manuals.
   2. Emergency manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated as part of the requirements for Substantial Completion. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

   1. Submit on digital media acceptable to Architect or by uploading to web-based project software site or by email to Architect. Enable reviewer comments on draft submittals.
   2. Submit three paper copies. Architect**,** will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.

2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.

3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.

3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify

each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for project record documents, including but not limited to:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings:
   1. Number of Copies: Submit one set of marked up record prints.
   2. Number of Copies: Submit copies of record Drawings:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Submit record digital data files and one sets of plots.
         3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and three sets of prints.
         2) Submit record digital data files and three sets of record digital data file plots.
         3) Plot each drawing file, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic file of the Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and one annotated PDF electronic file and directory of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked up Product Data as a component of manual.

D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 PROJECT RECORD DOCUMENT PROCEDURES

A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference.
   1. Do not use As Built Drawings and Specifications for Record Drawings and Specifications.

B. Recording Procedures: Update drawings and specifications on daily bases to record actual conditions. Record information concurrently with construction progress. Do not conceal Work until required information is accurately recorded.

C. Store Record Documents and samples apart from as built documents used for construction.
   1. Label and file Record Documents and samples in accordance with section number listings in Table of Contents. Label each document *PROJECT RECORD* in neat, large, printed letters.
   2. Maintain Record Documents in clean, dry and legible condition.
   3. Make Record Documents and samples available for inspection upon request of Architect.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked up paper copies of the Contract Drawings and Shop Drawings.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked up record prints. Show actual installation conditions where installation varies from that shown originally.
      a. Give attention to information on concealed elements difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross reference record prints to corresponding shop drawings or archive photographic documentation.

   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.
      n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked up record prints.
4. Mark record sets with erasable, red colored pencil. Use colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare full set of corrected digital data files of the Contract Drawings:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings and annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    a. Refer to Section 01 33 00 for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation *PROJECT RECORD DRAWING* in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
    a. Project name.
    b. Date.
    c. Designation PROJECT RECORD DRAWINGS.
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Indicate actual product installation where installation varies from that indicated in Specifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and marked up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 RECORD SAMPLES

A. Record Samples: Determine with Architect and Owner which submitted Samples are to be maintained as Record Samples. Maintain and mark one set to indicate date of review and approval by Architect; note any deviations or variations between reviewed sample and installed product or material.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by the individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Include the following:
   1. Reviewed shop drawings, product data, and samples.
   2. Field test reports.
   3. Inspection certificates and manufacturer's certificates.
   4. Inspections by authorities having jurisdiction (AHJ).
   5. Documentation of foundation depths.
   6. Special measurements or adjustments.
   7. Tests and inspections.
   8. Surveys.

9. Design mixes.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked up miscellaneous record submittals. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.
4. O&M Manuals should be uploaded into Owner’s designated software (Prolog)

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
1. Identification: On each copy, provide an applied label with the following information:
   a. Name of Project.
   b. Name and address of videographer.
   c. Name of Architect.
   d. Name of Contractor.
   e. Date of video recording.

2. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project record documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 01 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain

systems, subsystems, and equipment not part of a system.
1. Owner will furnish an instructor to describe Owner's operational philosophy.
2. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner through Program Manager with at least 10 days' advance notice.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Architect.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

END OF SECTION 01 79 00

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 building 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 **building** 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 **building.** 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 35 46

CONCRETE TOPICAL TREATMENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included:
   1. Application of densifier/hardener to existing concrete floor slabs.

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 40°F and 90°F. 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. Densifier/Hardener Basis of Design: Provide Seal Hard as manufactured by Laticrete International, a densifier and dustproofer for concrete surfaces that produces a colorless, hardened, durable and abrasion resistant surface subjected to pedestrian and vehicle traffic.
   1. Acceptable Manufacturers:
      Euco Diamond Hard; Euclid Chemical
      Seal Hard; L&M Construction Chemicals/Laticrete International
      Liqui-Hard; W. R. Meadows
   2. Substitutions for Equivalent Products: Refer to SECTION 01 62 00 - PRODUCT OPTIONS for substitution request procedures.
   3. Meets the following Standard and Test Method requirements:
      a. Fed. Spec. CEGS 03300 4-79
      b. ACI 302, Class 1 through 4 Concrete Floors

PART 3 - EXECUTION

3.1 PREPARATION:

A. Prepare concrete surfaces to be hardened according to manufacturer's recommendations.
   1. Remove all existing curing compounds, oil, grease, laitance, and other incompatible materials.

2. Apply [hardener 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. 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.

B. Apply only to areas where hardened concrete floor finish is scheduled.

C. 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 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.

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 brick required.

D. Provide a diagram of proposed control joints and expansion joints.

E. Mortar Mixture Proportions: ASTM C 270, Submit copies of each proposed mix design for review prior to starting masonry work.

F. 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.

G. 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.

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: Modular size face brick or hollow brick with actual dimensions of 3-5/8”D x 2-1/4"H x 7-5/8"L. Provide brick to match existing to remain. Manufacturer's identification on brick will not be acceptable.
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.

B. Common Brick: ASTM C 62, Grade MW, hard-burned stiff mud or dry-pressed brick. Use common brick where concealed brick is required.

C. Related Materials:
1. Bond Breaker: ASTM D 226, Type I (No. 15), non-perforated asphalt-saturated felt.

2.2 REINFORCING AND TIES

A. 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.

B. 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 and mortar used in laying glazed structural facing tile and glazed brick.
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: Custom blended 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 custom 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 custom 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

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 GROUT; PRE-BLENDED

A. Contractor's Option: Provide pre-blended grout mix as manufactured by SPEC MIX, Inc. (phone 888.773.2649 web site: www.specmix.com), instead of field-prepared grouts, NO SUBSTITUTIONS. SPEC MIX pre-blended grout option shall include manufacturer's standard silo system for mixing and delivery of grout mixes.
   1. Equivalent products by Quikrete Cement and Concrete Products–Dallas (800.627.6125) will be considered acceptable.
   2. Pre-blended grout mixes shall be mixed with potable water in strict compliance with manufacturer's written instructions and recommendations.

B. SPEC MIX Core Fill Masonry Grout:
   1. Material: Pre-blended factory mix of cementitious materials and dried aggregates meeting ASTM C 476 requirements for reinforced masonry construction.
   2. SPEC MIX Core Fill - Fine Grout: Pre-blended mix containing cementitious materials and fine aggregate designed to fill masonry voids two inches or less.
   3. SPEC MIX Core Fill - Course Grout: Pre-blended mix containing cementitious materials and coarse aggregate designed to fill masonry voids greater than two inches.

C. Mixing: Mix grout using manufacturer's standard mechanical mixer to ensure homogeneity and workability. Observe mixing time of 5 minutes, consistent from batch to batch. Use clean, potable water; add the maximum amount consistent with optimum workability.
   1. Discard unused grout 1.5 hours after initial mixing.

2.8 BRICK CLEANERS AND SEALERS

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.

B. Burnished/Ground Face Block:
   1. Provide "Sure Klean Light Duty Concrete Cleaner" as manufactured by ProSoCo, Inc. or approved equivalent.
   2. Provide Blok-Guard & Graffiti Control as manufactured by ProSoCo Inc. or approved equivalent.

2.9 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.

B. 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

C. 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. Confirm cavity width for the following thicknesses of cavity drainage materials:
a. Provide single thickness 2” material at 1-3/4” to 2-1/4” wide masonry cavities.
b. Provide single thickness of 1-1/2” material at 1-1/4” to 1-5/8” wide masonry cavities.
c. Provide single thickness of 1” material at masonry cavities less than 1-1/4”.

D. Cavity Drainage Material: Free-draining nonabsorbent polymer mesh, made from 100% recycled plastic products. Product/manufacturer; CavClear Masonry Mat (phone 888.436.2620 web site: www.cavclear.com).

E. 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. Wetting of Face Brick:
1. Draw a 1" circle with wax crayon on the bed surface of dry brick. Using medicine dropper, place 20 drops of water inside circle and measure time required for absorption of water.
2. If water is absorbed in less than 1-1/2 minutes, brick must be wet before being laid.
3. Brick shall have no visible moisture when laid.

B. 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 units except for special details. If units other than modular units are used, there shall be no change in story heights or other main dimensions of partition centerlines, and connecting work shall be adjusted to changes in unit sizes.

C. Laying Brick: Lay brick level, plumb, straight, and true to line within tolerances specified above. Spread the mortar bed full width and relatively smooth. Do not furrow. Butter the end of each brick with mortar and shove into place to completely fill the head joint. Do not feather the brick with excess mortar cut from the bed.
1. At concrete foundations and beams, install bond breaker between first course of brick veneer and concrete bearing. Gaskets at bottom of cavity walls shall not be used as bond breakers unless gasket occurs under the first course of brick.
2. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units to provide patterns shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Remove cut misfits and replace with properly cut units.
3. Lay brick with special coursing and jointing as detailed. Lay rowlock and soldier courses with uniform joints approximately 3/8" wide. Use uncored brick for the exposed ends of such courses and wherever the holes would be exposed.
4. When laying walls, keep the air space free and clear of mortar droppings and debris.
5. Unless shown otherwise, provide vertical control joints every 40'.
6. Refer to Expansion Joint Paragraph for Expansion Joints (Control Joints).

D. .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. Reinforcement shall not occur in the same joint course as the masonry veneer anchors.
4. Install strips in bed joints of concrete masonry unit veneer spaced 16” o.c. vertically.
5. At concrete masonry unit veneer, discontinue horizontal joint reinforcement across control joints and reinforcement shall not occur in the same joint course as the masonry veneer anchors.
6. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.

E. Reinforcing Masonry Joints at Masonry Veneer Not Laid in Running Bond: Reinforce the bed joints of masonry veneer with continuous wire reinforcement.
1. Install entire length of longitudinal wire in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
2. Connect seismic clip to every masonry veneer wall tie/pintel and to the continuous wire reinforcement.
3. Space reinforcement not more than 18 inches o.c. vertically.
4. Extend reinforcement a minimum of 8” into adjacent running bond masonry veneer.
5. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
6. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

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 backup construction 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. 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.

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. Tool the joints in masonry walls behind chalkboards and tackboards.
2. Rake out the joints to be caulked and keep them free of mortar as the work progresses.
3. Provide control joints at inside corners with backer rod and sealant.
4. Mortar color changes: Location of mortar color changes in relation to masonry color changes shall be as directed by Architect. Contractor shall rake and point mortar joints or otherwise alter standard masonry procedures to satisfy this requirement.

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. Chases: Form chases and recesses to the required dimensions and lines, strike joints flush and remove excess mortar. Before closing chases and similar inaccessible spaces with masonry, remove rubbish and sweep out the area.

J. Flashing:
1. Build in flashings which enter the masonry, using the materials and following the instructions of the pertinent sections of the specifications.
2. Create end dams at ends of window heads, 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.

K. Weeps: Install weep holes in veneer at 24" o.c. 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.

M. Expansion Joints (Control Joints):
1. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.
2. 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.
3. Provide vertical expansion joints in masonry (concrete masonry unit and brick), as follows:
   a. Where shown on drawings.
   b. Horizontal expanse:
      1) Brick:
         a) 25’-0” max. spacing at walls without openings. Spacing includes the sum of the distance around outside corners.
         b) 20’-0” max. spacing at walls with openings. Spacing includes the sum of the distance around outside corners.
   c. Within 2'-0" of outside corners.
   d. At all inside corners.
   e. Change of substrate including but not limited to the following:
      1) Concrete masonry unit to metal stud back-up.
      2) In masonry wall at intersection of concrete beam supported masonry and structural steel supported masonry.
   f. As recommended by referenced standards.
4. Control joints shall extend continuous through bond beam although concrete and reinforcement for bond beam shall extend continuous through control joint.

N. 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.

O. 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.

P. 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.

Q. 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.

R. Building Expansion Joints: Discontinue horizontal joint reinforcement across building expansion joints.

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 and other unfinished exposed openings 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 face brick with a commercial cleaner. Test the cleaner on an inconspicuous area of face brick to insure that it performs as intended without leaving scum or residue. Before the solution is applied, soak the brick 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 glazed facing tile with brushes and clean water. Use no acids or abrasives.
3. 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.

C. Cleaning Existing Exterior Masonry:
1. Where existing masonry is scheduled to be cleaned, use high pressure water cleaning equipment with nozzle pressures between 400 psi and 700 psi and a flow rate of 3 to 8 gallons per minute.

2. Select and test recommended cleaning solution on a sample area.
3. Protect metal, glass, and wood by masking or other methods, as approved by Architect.
4. Presoak or saturate area to be cleaned by flushing with clean water from the top down.
5. Apply cleaning solution to wall.
6. Starting at the top of the wall, flush the wall down.
7. Repeat process as required for proper cleaning.

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.).

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 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sealing and caulking of joints.

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.

C. 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, Master Builders Solutions, a brand of MBCC Group.

D. 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; Master Builders Solutions, a brand of MBCC Group.
THC 900 (Self leveling) or 901 (low sag), Tremco.

E. Silicone, General Purpose (Type 3 Sealant)
1. One-part low modulus rubber based silicone conforming to ASTM C 920, Type S, Grade NS, Class 100/50.
2. Color: As selected by Architect.
3. Acceptable products
Dowsil 790 Silicone Building Sealant, Dow Corning.
SCS2700 Silpruf LM, GE Silicones.
Spectrem 1, Tremco.

F. Acrylic Latex (Type 4 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; Master Builders Solutions, a brand of MBCC Group.
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.
1. At Exterior Insulation and Finish Systems, provide closed cell at both horizontal and vertical joints.

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. At joint width 1” or more, reference SECTION 07 95 00 - EXPANSION CONTROL.
	b.	Vertical joints at perimeter of window, door, and storefront elements where adjacent to stone, masonry, or concrete surfaces.
2	a.	Interior horizontal control and expansion joints in flooring, stone, masonry and tile flooring and at junctures between these materials and other adjacent materials.
3	a.	Sealing of joints between plumbing fixtures and substrates and between plastic laminate splashes and adjacent tops and walls.
4	a.	General caulking as part of interior painting.

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 04 20 00 – Masonry
2. Section 05 40 00 - Cold-Formed Metal Framing: exterior wall studs.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
4. Section 07 21 00 - Building Insulation: acoustical and thermal insulation.
5. Section 07 84 00 - Firestopping.
6. Section 09 30 13 - Ceramic Tiling: backer board at shower areas.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 00 - SUBMITTAL PROCEDURES.

B. Submit materials list of items proposed to be provided, manufacturer's data indicating compliance with specified requirements, and manufacturer's recommended installation procedures.

C. 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 60 00 - PRODUCT 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: 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. Water- and Mold-Resistant Gypsum Board: ASTM C 1396. Provide Type X, water and mold resistant; 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Gypsum board to be covered with ceramic tile in toilets, EWC alcoves, and other wet areas (except showers) shall be specially processed moisture-resistant gypsum board. Product/manufacturer; one of the following:
   M2Tech Type X; CertainTeed Gypsum
   ToughRock Fireguard X Mold-Guard Gypsum Board: G-P Gypsum Corp.
   Gold Bond XP Fire-Shield Gypsum Wallboard; National Gypsum Co.
   Sheetrock Brand Mold Tough Firecode X Gypsum Panel; USG Corporation

C. Abuse-Resistant Gypsum Board: 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

D. Gypsum Tile Backer Board: Refer to Section 09 30 13 - CERAMIC 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.

E. Sheathing Board System: Reference SECTION 06 16 56 - AIR- AND WATER-RESISTIVE SHEATHING BOARD SYSTEM.

F. 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.

G. 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.

H. 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.

I. 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.

J. Adhesive: Utilize adhesive meeting requirements of GA-216 over metal framing.

K. 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: 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: 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. Porcelain Tile.
2. Quarry Tile.
3. Tile Trim and Accessories.

B. Related Sections:
1. Section 07 92 00 - Joint Sealants.
2. 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.
2. Submit tile manufacturer's written recommendations for sealing specific quarry tile for this project.

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. Quarry Tile: As scheduled; refer to Drawings.
   1. Size: 6" x 6" x 1/2" units with square edges.

D. 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.

E. Floor Tile Wet Dynamic Coefficient of Friction: Not less than 0.42, when tested in conformance with ANSI A137.1.

2.2 QUARRY TILE PROTECTION AND TREATMENT MATERIALS

A. Temporary Protective Coating: Provide one of the following products to protect exposed surfaces of tile against adherence of mortar and grout:
   1. Petroleum paraffin wax, fully refined, tasteless, odorless, containing at least 0.5% oil with a melting point of 120°F. to 140°F. per ASTM D 87.
   2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary coating for tile.

B. Unglazed Quarry Tile Sealer: Provide Seal 341 low lustre, non-buffing type seal-finish as manufactured by Hillyard. Sealer shall be slip resistant.

2.3 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 for use at larger format tile (over 12 x 12 inches) on walls: 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 kitchen, 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.

J. Quarry Tile Cleavage Membrane: ASTM D 226, No. 15 asphalt saturated roofing felt or 4-mil thick black polyethylene sheeting.

2.4 QUARRY TILE JOINT TREATMENT MATERIALS

A. Joint Filler: ASTM D 1752, Type I, pre-molded closed-cell, sponge rubber expansion joint material.

B. Divider Strips: Equal to 1-1/4" deep brass strips by Manhattan American Terrazzo Strip Company as listed below:
   1. At quarry tile abutting vinyl composition tile, furnish "Edging Strip" having 1/8" recess to receive the resilient tile.
   2. At quarry tile abutting carpet, furnish "Heavy Top Strips" in 1/4" width.

2.5 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.

2.6 ADHESIVE/WATERPROOF MEMBRANE

A. 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.

2.7 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 for transition to VCT at door locations: Provide RENO-AEU 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 for locations other than doors where flush transition to VCT is desired: Provide DECO-AE 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.

C. Metal Corner and Top of Wainscot Trim: Provide RONDEC-AE clear satin anodized aluminum corner trim by Schluter Systems L.P. [Color shall be selected from manufacturer’s complete color range].

D. Cove-Shaped Aluminum Trim (14F): Provide DILEX-AHK anodized aluminum profile trim, by Schluter Systems L.P., with integrated trapezoid-perforated anchoring leg, connected at a 90-degree angle by a cove-shaped section with 3/8" radius that forms the visible surface. Provide all matching inside and outside corners, connectors, and end caps. Material and Finish shall be Brushed Nickel Anodized Aluminum (ATGB). Height(s) as required.

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. Crack Isolation Membrane at 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.

C. Quarry Tile Preparation:
1. For floors in the Kitchen area, place clean sand over the concrete, screed level to a thickness of 1/4", and cover with cleavage membrane. Lap the joints 2".
2. For floors in other locations, clean the concrete with water and leave damp just before the setting bed is placed.
3. Field-Applied Temporary Protective Coating: Protect exposed surfaces of tile against adherence of mortar and grout by pre-coating them with a continuous film of either petroleum paraffin wax or grout release temporary protective coating; taking care not to coat unexposed tile surfaces.

D. Preparation for Thin Tile:
1. Maximum allowable variation of subsurface cannot be more than 1/8" in 10'and no more than 1/16" in 3', with no abrupt irregularities greater than 1/32".
2. Maximum lippage shall be less than 1/32" to prevent damage to the tile.
3. Trowel apply Skim Coat & Patch Cement Underlayment smoothing compound to eliminate imperfections in walls to bring the surface into the acceptable tolerance.

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. Setting Thin Wall Tile:
1. Follow all TCNA recommendations for the installation of porcelain tile.
2. To assure that the tiles do not crack from impact, it is mandatory that the mortar coverage is greater than 95% and all edges of the tile be supported.
3. To achieve continuous contact between the substrate and tiles, a paint roller or a rubber flooring roller may be used.
4. Exercise caution when checking these thin porcelain tiles for coverage as removing the thin tile can cause them to crack.

F. 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.

G. Quarry Tile Expansion Joints: Provide 3/8" wide expansion joints where tile work abuts restraining surfaces such as perimeter walls and curbs and at intervals in the field.
1. Form expansion joint with the joint filler extending down through the mortar bed to the concrete slab. Top of joint filler shall be held approximately 3/8" below the finish tile surface.
2. Clean the joint and fill full of sealant. Tool the sealant smooth to approximate the appearance of the standard grouted joints.

H. Setting Quarry Tile Divider Strips: Where quarry tile is indicated to abut vinyl composition tile and carpet without a threshold, install the strips specified above.

I. 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.

J. 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.

K. 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.

L. Metal Corner and Top of Wainscot Trim:
   1. Provide at all outside corners and top of wainscot of ceramic wall tile.
   2. Set metal corner trim prior to installing wall tile.
   3. Set tile up to corner trim with a factory cushion edge. Provide a 1/8” joint between tile and trim. Trim shall be flush with faces of ceramic tile.
   4. After tile work and grout are dry, clean the joint between the trim and the tile.
   5. Fill joint 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.

B. Quarry Tile Work:
   1. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to grout manufacturer. Trap and remove coating to prevent it from clogging drains.
   2. Unglazed Quarry Tile Sealer:
      a. Allow floor to set 30 days to insure proper curing of grout joints.
      b. Scrub floor with 1 part Hillyard Renovator to 8 parts hot water (16 oz./gal.). Rinse thoroughly.
      c. The final cleaning of floors is extremely important to successful application of sealer to insure that floor is clean and free of all surface stains and soiling. Do not seal in the dirt nor stains.
      d. When floor is thoroughly clean and dry, apply sealer with a clean rayon mop. Allow one hour dry time and apply second thin coat. Allow second coat to dry one hour and apply third thin coat. Allow sealer to cure properly prior to allowing foot-traffic on new sealed floors.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical panels and exposed suspension systems 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. (C-01) Acoustical Lay-in Panels ASTM E 1264, mineral fiber panels, Type III, Form 2, Pattern C E, Class A (non-combustible) and having an NRC range of min. 0.50-0.60.
   1. Product / manufacturer; one of the following:
      a. Fine Fissured Humiguard No. 1728; Armstrong World Industries, Inc.
      b. Fine Fissured Safetone; CertainTeed Corporation
      c. Radar ClimaPlus; USG Interiors, Inc.
   2. Size: 24" x 24" x 5/8"
   3. Design: Perforated, small holes; Lightly textured surface.
   4. Finish: Washable factory applied vinyl latex paint.
   5. Color: White.
   6. Edges: Square.

B. Suspension System; Acoustic Lay-in Panels: 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.
   6. Fire resistive systems shall be UL listed and labeled for a 1-hour time-design rating.

C. Perimeter Trim System for Suspended Ceiling System: Provide AXIOM Classic 4" and 12" high extruded aluminum trim as manufactured by Armstrong. Provide manufacturer*s standard splice plates, clip brackets, and support brackets with no visible fasteners. Color shall be as selected by Architect from manufacturer's standard color range.

D. Suspension System: 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.

E. Metal Power and Projector Ceiling Panel: The ceiling fixture shall be a Peerless Model CMJ 450 Suspended Ceiling Kit, or equivalent, and shall be mounted where indicated in the drawings. It shall feature a steel ceiling plate featuring two electrical box knockouts, one circular knockout, and a tie wire support system with turnbuckles for precise tensioning of the wires. All hardware for attachment to supporting structure shall be included. The finish shall be scratch resistant white fused epoxy. It shall be UL Listed. Assembly and installation shall be done according to the instructions provided by the manufacturer.

F. Hangers: 12 gage annealed and galvanized steel wire.

G. Hold-down Clips: UHDC Universal Hold Down Clip by Armstrong.

H. Direct Load Ceiling Clip: DLCC as manufactured by Armstrong.

I. Column Rings: Provide prefabricated clamp rings to support suspended ceiling at all round column locations within acoustical ceilings. Column rings as manufactured by Fry Reglet or Gordon.

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. Lay-in Panels: Install the acoustic panels in the exposed suspension system with bottom surfaces flush and in a true, level plane.
   1. Provide hold-down clips at lay-in panels within 6' of exterior exits.

E. 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.

F. Direct Load Ceiling Clips: Provide 2 direct load ceiling clips and hanger wire at each overhead projection screen.

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 64 29.13

REFINISHING OF WOOD STRIP FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Refinishing of wood strip flooring system.

1.2 QUALITY ASSURANCE

A. The work shall be done by an experienced applicator using trained mechanics skilled in the refinishing of hardwood floors.

1.3 PROJECT CONDITIONS

A. Environmental Requirements: Maintain the ambient temperature between 70°F. and 90°F. from 72 hours before installation until 48 hours after work is complete. Thereafter, keep the temperature above 55°F. degrees until final acceptance of the building.

B. Protection: Protect wood flooring from damage during and after installation. Cover traffic areas with paper and maintain until final acceptance of the building.

1.4 WARRANTY

A. The wood flooring finishing shall be warranted in writing to the Owner against defects in material and workmanship for 2 years from the date of final completion. This warranty shall stipulate that the floor will be repaired and refinished at no extra cost to the Owner within the 2 year period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Finishing Materials:
1. Penetrating Seal: Gold Medalist Wood Seal durable urethane sealer as manufactured by Hillyard Industries, Inc.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine area to refinished for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

B. The finishing of the wood floor should be one of the last operations in the building construction.

3.2 SANDING

A. Scrape and sand wood floor to a smooth, unblemished surface. Brush and vacuum the surface clean and otherwise prepare for finishing.

B. It may be necessary to use a very coarse "open coat" paper to remove the old finish. The heat and abrasion of the sanding operation make the old finish gummy and may quickly clog normal sanding paper. First try regular paper (particularly on a diagonal). If 90% of the finish is removed and the floor is generally flattened, coarser grits are not necessary.

C. The number of sanding passes required for "Refinishing" will be largely determined by the condition of the existing floor and the thickness of the finish being removed. All of the old finish shall be removed. Use as many cuts as are necessary to get a smooth, unblemished surface.

D. Make the first cut at a 45° ± angle to the flooring direction with medium grit paper to level the floor and remove 90% of the finish. Then follow the instructions given for sanding a new floor on the succeeding cuts. Use the same grit paper as was used on the 45° cut for the first cut parallel to the flooring strips.

E. While sanding, immediately mark exposed nails, slight hollows, excessive scratches, holes to be filled, etc. with a soft lead carpenters pencil.

F. To change from coarse to medium to fine grits, do not skip more than one intermediate grit. (i.e. 40 skip 50 use 60, 60, skip 80 use 100)

G. When buffing sealers/stains, or between finish coats, always start in an inconspicuous place.

H. Repair/replace any split boards or seriously damaged areas of the surface with same grain, thickness and grade of existing wood flooring.

3.3 FINISHING

A. Apply the floor finishes immediately after the final sanding and in accord with the manufacturer's directions.
   1. Apply four coats of penetrating sealer, buffing and cleaning between each coat.
   2. After penetrating sealer has thoroughly cured, clean surface with towel dampened with water. Apply two coats of wax allowing one hour's drying time between coats.

3.4 PROTECTION

A. Cover installed wood flooring to protect it from damage or deterioration, before and after finishing, during remainder of construction period. Use heavy Kraft paper, or other suitable covering. Do not use plastic sheet or film that could cause condensation.
   1. Do not cover site-finished floors with Kraft paper, or any other materials, until finish reaches full cure, but not less than 7 days after applying last coat.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: 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.

1.3 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 48 hours prior to installation of r**ubber products.**

1.4 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.

1.5 **WARRANTY**

A. Rubber Base Warranty: Provide Standard 2-year manufacturers’ warranty that materials is free from manufacturing defects.

1.6 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. 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 SECTION 09 99 00 - COLOR SCHEDULE. 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:
Wallflowers® Premium Wall Base; Flexco
Baseworks™ Thermoset Rubber Wall Base; Tarkett/Johnsonite
Pinnacle Type TS Rubber Base; Roppe Rubber Corp.
NO SUBSTITUTIONS on Type TS (rubber, vulcanized thermoset)

B. 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.

C. 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

3.3 INSTALLATION

A. 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 65 44

LINOLEUM TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient tile flooring and accessories.

1.2 SUBMITTALS

A. General: Refer to SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES:
   1. Samples: Submit Manufacturer's standard color samples of tile, minimum 3x3 inches, full thickness. Include samples of each accessory, full height or width by not less than 2 inches in length.
   2. Product Data: Manufacturer's complete product information including installation and maintenance instructions.

B. Concrete Slab Testing: Proceed with installation only after substrates pass testing.
   1. Submit the following for Alkalinity and Adhesion Testing:
      a. Result of pH tests.
      b. Written documentation of acceptable pH levels of selected Flooring Manufacturer.
      c. Letter from Flooring Manufacturer stating that floor alkalinity is acceptable and Manufacturer will issue warranty.
   2. Submit the following for Relative Humidity Probe Tests:
      a. Results for in situ relative humidity probe tests.
      b. Date and time measurements were made.
      c. Locations and depth of probe holes.
      d. Temperature and relative humidity in each probe hole.
      e. 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. Letter from Flooring Manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
   3. Submit the following for Anhydrous Calcium Chloride Testing
      a. Time and date of placement and retrieval.
      b. Ambient air temperature and humidity during test duration
      c. 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. Letter from flooring manufacturer stating that floor moisture emission rates are acceptable and Manufacturer will issue warranty.

1.3 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.

1.4 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.

1.5 WARRANTY

A. Tile Warranty Terms: Standard 5-year manufacturer's warranty on defective materials.

1.6 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to the Owner's Maintenance Facility, not less than one box, for each type, field color, pattern, and size installed and one box, for each type, accent 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. Resilient Tile Flooring (RF-01): ASTM F 2195 Linoleum Tile Flooring, Type I, 13" x 13" x 1/10" thick tile as manufactured by Forbo. Provide Marmoleum® MCT linoleum tile composed of linseed oil, rosin binders, wood flour, limestone and dry pigments which are mixed and then calendared onto a polyester backing. Include Topshield™ water-based finish.
   1. Color; Pattern: As scheduled; refer to Drawings.

B. Resilient Tile Flooring (RF-02): ASTM F 2195 Linoleum Tile Flooring, Type I, Sizes 9.8" x 9.8" x 1/10" thick; 9.8" x 19.7" x 1/10", and 19.7" x 19.7" x 1/10" tile, all as manufactured by Forbo and as shown by Drawings.. Provide Marmoleum® Modular linoleum tile composed of linseed oil, rosin binders, wood flour, limestone and dry pigments which are mixed and then calendared onto a polyester backing. Include Topshield™ water-based finish.

C. Rubber Base: As specified by Section 09 65 00 – RESIILIENT FLOORING.

D. Edge Strips: 1" wide by 1/8" thick rubber tile reducer with beveled surface.

E. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by vinyl composition tile manufacturer.

F. Adhesive: Moisture-resistant type recommended by flooring manufacturer.

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. After installation is completed, allow a minimum of 5 days for the adhesive to properly bond and cure before conducting wet cleaning procedures.
   2. Remove excess adhesive and other foreign matter from tile flooring and base.
   3. Scrub floor with cleaner in conformance with manufacturer's instructions and rinse.
   4. 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.

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. Basis of Design: Stonhard, Inc. (phone 800.257.7953 web site: www.stonhard.com)

B. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work Include, but are not limited to:
   Dex O-Tex, Division of 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)
   Stonhard (phone 800.257.7953 web site: www.stonhard.com)

2.2 MATERIALS

A. Resinous Flooring: Basis of Design shall be Stontec ERF as manufactured by Stonhard, Inc. 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.
   2. Color and Pattern: As scheduled in "Material Finish Schedule" in drawings for resinous flooring complying with requirements indicated.
   3. Total Thickness of Body Coat(s): As recommended by manufacturer for system compliance with requirements.
   4. System Thickness: Minimum 1/8 inch.
   5. Wearing Surface: Antislip.
   6. Base: 4 inch high integral cove base.
   7. System Components: Manufacturer's standard components that are compatible with each other and as follows:
      a. Primer:
         1) Material Basis: Stonhard Standard Primer
         2) Resin: Epoxy
         3) Formulation Description: (2) two component 100 percent solids.
         4) Application Method: Squeegee and roller.
         5) Number of Coats: (1) one.
         6) Aggregates: Broadcast quartz into wet primer coat.
      b. Body Coat(s):
         1) Material Basis: Stonshield Undercoat.
         2) Resin: Epoxy.
         3) Formulation Description: (3) three component solvent free epoxy.
         4) Application Method: Notched squeegee.
            a) Thickness of Coats: 25-30 mils with standard primer coat
            b) Number of Coats: (1) One.
      c. Broadcast:
         1) Material Basis: Stontec Flakes
         2) Formulation Description: Large Decorative flake of 1/4"
         3) Type: Tweed (chips to be mixed in Mfg. facility)
         4) Finish: Broadcast to rejection.
         5) Number of Coats: one.
      d. Topcoat:
         1) Material Basis: Stonkote CE4
         2) Resin: Epoxy.
         3) Formulation Description: (2) component, UV stable, solvent free epoxy.
         4) Type: Clear.
         5) Finish: Gloss.
         6) Number of Coats: Two.
   8. Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to standard test methods indicated:
      a. Tensile Strength: 5,200 psi per ASTM D 638.
      b. Flexural Strength: 4,000 psi per ASTM D 790.
      c. Flexural Modulus of Elasticity: 1.7 x 10^6 psi per ASTM D 790.
      d. Hardness: .85-.900, Shore D per ASTM D 2240.
      e. Linear Coefficient of Thermal Expansion: 17 x 10^6 in./in.ºF per ASTM C 531.
      f. Impact Resistance: Exceeds 160 in.-lbs. per ASTM D-4060, CS-17.
      g. Abrasion Resistance: 0.03 gm maximum weight loss per ASTM D4060. CS-17.
      h. Flammability: Class I per ASTM E 648.

B. Accessory Materials
   1. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
   2. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

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. Mechanically prepare substrates as follows:
   2. Mechanically prepare with the use of Diamond grinding equipment to provide surface sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring. Or,
   3. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup or Diamond Grind with a dust free system.
   4. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
   5. 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: 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. Body coat: Mix base material according to manufacturer's recommended procedures. Uniformly spread mixed material over previously primed substrate using manufacturer's installation tool. Roll material with strict adherence to manufacturer's installation procedures and coverage rates.

H. Broadcast: Immediately broadcast decorative flakes into the body coat. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

I. First Sealer: Remove excess un-bonded flakes by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

J. Second sealer: Lightly sand first sealer coat. Mix and apply second sealer coat with strict adherence to manufacturer's installation procedures.

3.3 TERMINATIONS

A. Chase edges to “lock” the coating system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue coating system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the coating to lock in place at point of termination.

3.4 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints to and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Vertical and horizontal contraction and expansion joints are treated by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 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.

3.6 CLEANING AND PROTECTION

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring 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.

C. 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

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. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include manufacturer's installation instructions.

C. 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.

D. 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.

E. 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 Lifetime 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 (CPT-01, CPT-02): Provide Paradigm hybrid carpet flooring with 6' Powerbond Cushion RS backing as manufactured by Tandus-Centiva, a Tarkett Company. Carpet shall meet the following minimum requirements, NO EXCEPTIONS:
   1. Color as scheduled; refer to Drawings.
   2. Construction: Patterned loop
   3. Pile Height: .187 inch.
   4. Gauge: 5/64 minimum.
   5. Stitches Per Inch: 9.8
   6. Pile Density: 6,324
   7. Face Yarn: 100% branded nylon, Type 6 or Type 6,6. 100% Bulk Continuous Filament (BCF)
   8. Stain Resistance: AATCC-175, must pass Acid Red 40 spot test with an 8 or better.
   9. Dye System: Solution dyed and yarn dyed.
   10. Backing: Non-woven synthetic fiber. 100% thermoplastic composite (no latex or urethanes). Backing system must provide a 100% moisture barrier.
   11. Width: 6-foot broadloom.
   12. Fire performance characteristics:
      a. Surface Flammability (ASTM D-2859): Passes CPSC FF 1-70
      b. Flammability (ASTM E648): Class 1
   13. Appearance Retention; one of the following:
      a. ASTM D-7330 Method for Assessment of Surface Appearance Change in Pile Yarn Floor Coverings (Hexapod Test): Minimum 3.0 rating for heavy traffic.
      b. ASTM D5417 Vetterman Drum Test for 22,000 cycles. A minimum rating of 3.0 using CRI TM-101 Reference Scale.

B. Carpet (CPT-03): Provide Assertive Action hybrid carpet flooring with 6' Powerbond Cushion RS backing as manufactured by Tandus-Centiva, a Tarkett Company. Carpet shall meet the following minimum requirements, NO EXCEPTIONS:
   1. Color as scheduled; refer to Drawings.

2. Construction: Symtex®
3. Pile Height: .095 inch.
4. Gauge: 1/10 minimum.
5. Stitches Per Inch: 9.0
6. Pile Density: 10,989
7. Face Yarn: 100% branded nylon, Type 6 or Type 6,6. 100% Bulk Continuous Filament (BCF)
8. Stain Resistance: AATCC-175, must pass Acid Red 40 spot test with an 8 or better.
9. Dye System: Solution dyed.
10. Backing: Non-woven synthetic fiber. 100% thermoplastic composite (no latex or urethanes). Backing system must provide a 100% moisture barrier.
11. Width: 6-foot broadloom.
12. Fire performance characteristics:
    a. Surface Flammability (ASTM D-2859): Passes CPSC FF 1-70
    b. Flammability (ASTM E648): Class 1
13. Appearance Retention; one of the following:
    a. ASTM D-7330 Method for Assessment of Surface Appearance Change in Pile Yarn Floor Coverings (Hexapod Test): Minimum 3.0 rating for heavy traffic.
    b. ASTM D5417 Vetterman Drum Test for 22,000 cycles. A minimum rating of 3.0 using CRI TM-101 Reference Scale.

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 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.

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 AND PROTECTION

A. Remove access adhesive from floor, base, and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

C. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION

SECTION 09 72 16

VINYL-COATED FABRIC WALL COVERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vinyl-coated fabric wall covering.

B. Related Sections:
   1. Section 09 21 16 - Gypsum Board Assemblies: taping and bedding of gypsum board.

1.2 SUBMITTALS

A. Samples: Submit in accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples. Submit 6" square samples of each type of vinyl wall covering.

B. Certificate: The manufacturer of the proposed vinyl wall covering shall furnish to the Architect written certification that the material shipped to the project will meet the physical and performance requirements listed below. Certification from a dealer or distributor will not be acceptable.

C. Maintenance Instructions: Submit copies of the vinyl wall covering manufacturer's printed instructions for maintenance of the installed work.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Work shall be performed by a skilled applicator having at least five years' experience in the installation of vinyl wall covering.

B. 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 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to project site not less than 6 linear yards of each type, color, and pattern of vinyl wall covering installed. Furnish maintenance materials from same production run as materials installed. Other remnants, usable scraps, and overage in wall covering shall be packaged in appropriate wrapping, labeled, and delivered to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vinyl Wall Covering: FS CCC-W-408, Type II/Class A; supported vinyl material consisting of a pigmented and mildew inhibited polyvinyl chloride fused to cotton fabric. Wall covering shall have a flame spread rating of 25 or less when tested in accordance with ASTM E 84.
   1. Manufacturer, product, style, pattern, and color as scheduled; refer to Drawings .

B. Adhesive: Vinyl paste as recommended by the wall covering manufacture.

C. Substrate Filler: As recommended by adhesive and vinyl wall covering manufacturers; compatible with substrate.

D. Substrate Primer and Sealer: Type as recommended by vinyl wall covering manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive vinyl wall covering 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. Clean surfaces to receive vinyl wall covering, including dirt, grease, oil, other contaminants. Surfaces shall be dry, smooth, and clean. Protrusions or low spots must be sanded or filled, as needed, to achieve a smooth surface.

B. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

C. Remove electrical plates and covers, light fixture trims, and similar items.

3.3 INSTALLATION

A. Applying Wall Covering: Follow the manufacturer's printed instructions for cutting and installing vinyl wall covering.
   1. Use fabric panels in exact order as they are cut from rolls; use rolls in consecutive order. Apply paste to the fabric back using a roller or paste brush.
   2. Trim deeply textured patterns, or patterns on which strip must be matched, on the worktable. Use a metal straight edge and sharp blade.
   3. Handle smooth, non-match patterns by pasting strips on the wall, overlapping the edge and "double cutting" through both thicknesses. Use thin metal strip between wall and material when cutting to avoid gouging the wall.
   4. Use stiff-bristled brush or flexible broad knife to eliminate air pockets and to secure the wall covering to the wall surface.
   5. Fill in spaces above doors and similar areas in sequence from the roll.
   6. Remove excess adhesive from each seam as it is made. Use sponge dampened with warm water. Wipe seam clean with dry cloth towel.
   7. Examine each seam carefully when completed. Trim additional selvage where required to achieve a color and pattern match at seams.
   8. Install seams vertical and plumb at least 6" from outside corners and 6" from inside corners, unless a change of pattern or color exists at corner. No horizontal seams are permitted.
   9. Except on match patterns, hang panels by reversing alternate strips.
   10. The installed fabric shall be secure, smooth, and clean without wrinkles, gaps or overlaps.

3.4 CLEANING

A. Clean vinyl wall covering with mild soap powder dissolved in warm water, and remove excess adhesive at joints and on adjacent surfaces.

B. Replace vinyl wall covering that cannot be successfully cleaned or that is applied to defective substrate surfaces.

C. Reinstall electrical plates and covers, light fixture trims, and similar items.

END OF SECTION

SECTION 09 84 13

FIXED SOUND-ABSORPTIVE/SOUND-REFLECTIVE PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical wall panels.

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 FIBERGLASS CORE ACOUSTICAL WALL PANELS

A. Acoustical Wall Panels: Provide acoustical wall panels as manufactured by one of the following:
AVL Systems, Inc.
Kinetics Noise Control, Inc.
Conwed Designscape (Owens Corning)
QTS Quiet Technology Systems
Decoustics. Ltd (Saint-Gobain)
RPG Acoustics
Golterman & Sabo, Inc. (G&S Acoustics)

B. 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.
1. Acoustical Wall Panel: Absorption Panel (Kinetics Hardside):
a. Panel Core: 6 to 7 pound per cubic foot multiple density core.
b. Panel Fabric and Color: Panel Fabric and colors as scheduled in “Material Finish Schedule” in drawings.
c. Panel Size: Minimum 2" thickness, or as required to meet sound absorption specification, face dimensions as required.
d. Sound Absorption (ASTM C423): Noise Reduction Coefficient (NRC) minimum value 1.00 for a Type A (#4) mounting or Type D-20 (#2) mounting, whichever mounting method will be used to meet the specified NRC

C. Flammability (ASTM E 84): Flame Spread 25 or less.

D. Hardware: Manufacturer's standard concealed mounting hardware consisting of panel, wall and leveling clips.

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 concrete ceiling and beam surfaces.
      e. Gypsum board.
      f. Interior caulked joints.
      g. Portland cement plaster.
      h. 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:
   1. If painting materials other than those specified are proposed for use, submit a complete schedule of the materials to be substituted.
   2. This schedule 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.
   3. Provide data sheet for each paint type listed in schedule.

C. Federal law requires renovation firms (including sole proprietorships) to be certified and requires individuals to be trained in the use of lead-safe work practices. Contractors who perform renovation, repairs, and painting jobs shall:
   1. Provide a copy of your EPA lead training certificate.
   2. Show what lead-safe methods you will use to perform the job.
   3. Provide references from at least three recent jobs involving projects before 1978.
   4. Keep records to demonstrate that you and your workers have been trained in lead-safe work practices and that you follow lead-safe work practices on the job.

D. 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. 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.

B. Minimum application temperatures for latex paints: 45°F. for interiors; 50°F. for exterior; unless required otherwise by manufacturer's instructions.

C. Minimum application temperature for varnish and finishes: 65°F. for interior or exterior, unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 ft.-candles measured mid-height at substrate surface.

E. 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.

F. 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 & Co. (https://www.benjaminmoore.com)
PPG Paints (https://www.ppgpaints.com)
The Sherwin-Williams Co. (https://www.sherwin-williams.com)

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. Reference “Material Finish Schedule” in drawings. 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. Gypsum wallboard: 12 percent.
2. Plaster: 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. Sand woodwork surfaces smooth before priming.

D. Coat pine knots and pitch streaks with shellac before painting.

E. Putty nail holes after the prime coat.

F. 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.

G. 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.

H. 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, including backs of cabinet doors, 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. Apply the finish coat on gypsum board, plaster, and concrete surfaces with rollers.

I. On concrete masonry unit wall surfaces without a block filler, apply the first coat of paint with a spray gun.

J. Apply paint to sound absorbing concrete masonry units with brushes and/or rollers; do not spray.
1. Do not paint fibrous fillers of sound absorbing concrete masonry units.
2. Do not allow any paint, primer, or block filler to enter acoustic cells or impinge upon acoustic fillers in any way, including but not limited to, by overspray of spray-applied paint, or by drips, runs, sags, or splashes of paint, or through careless or negligent application of paint.
3. No paint shall be allowed on fibrous fillers of sound absorbing concrete masonry units; otherwise, sound absorbing concrete masonry units and fibrous fillers shall be replaced at no cost to Owner.

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 **RE-PAINTING**

A. Locations and Extent: The re-painting of existing surfaces shall be as follows:
1. Painted wall, door and frame surfaces which have been reworked, cut into or patched, whether specifically designated on the drawings or not. Re-painting shall include all openings in existing walls.
2. Entire rooms/areas, as designated on the drawings**.**

B. Colors: Match existing colors of corresponding surfaces except where new colors are scheduled**.**

C. Preparation:
1. Clean surfaces to remove dust and dirt. Remove oil, grease, wax, loose paint, mill scale dirt, foreign matter, rust, mold, mildew, mortar, efflorescence, and sealers and other contaminants which would inhibit paint bonding to the old paint.
2. Remove rust and loose and flaking paint by scraping and sanding.
3. Glossy surfaces of old paint films **and ceiling grid** must be clean and dull before repainting. Thorough washing with an abrasive cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding.
4. Spot prime any bare areas with an appropriate primer in conformance with the following paint schedule for new work.
5. Check for compatibility by applying a test patch of the recommended coating system, covering at least 2 to 3 Sq.Ft. Allow to dry one week before testing adhesion per ASTM D 3359. If the coating system is incompatible, complete removal of existing finish is required.
6. Tectum Panels: Surface must be clean, dry, and in sound condition. Remove all oil, dirt, grease, and other foreign material to ensure adequate adhesion.

D. Painting: Generally, apply one coat of finish paint over old surfaces, using the same materials scheduled in the paint schedule for like new surfaces**.**

E. Verification: Verify the extent of re-painting work at the building and make due allowance for cutting and patching required for installation of mechanical and electrical work.

3.6 PAINT SCHEDULE

A. The products listed below represent top of the line products of each manufacturer. These products are not presented as being equivalent, as there are too many variables to match each product across the board. Manufacturer's designations are:
PPG Pittsburgh Paints
SW The Sherwin-Williams Co.

B. Interior Metal
1. Steel door frames, borrowed light frames, louvers and vision panel frames in doors, hollow metal doors, sound retardant doors, and ladders.
1 primer coat

PPG Red Inhibitive Steel Primer, 6-208
SW Kromik Metal Primer E41N1
2 finish coats
PPG Speedhide 6-1110
SW ProMar 200 Alkyd Semi-Gloss Enamel, Series B34 W 200

2. Steel pipe handrails and railings.
1 primer coat
PPG Red Inhibitive Steel Primer, 6-208
SW Kromik Metal Primer E41N1
2 finish coats
PPG Int/Ext Industrial Gloss Alkyd, 7-282 Series
SW Industrial Enamel, Series B54
3. Grilles, diffusers and registers in walls and ceilings.
1 finish coat
PPG Speedhide Alkyd Lo-Sheen, 6-90
SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200
4. Other exposed iron and steel.
1 primer coat
PPG Speedhide Inhibitive Steel Primer, 6-208
SW Kem Kromik Metal Primer, B50 W 1
1 finish coat
PPG Speedhide Alkyd Lo-Sheen, 6-90
SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200
5. Metal pipe, conduit, ductwork, hangers, supports and brackets.
1 primer coat
PPG Speedhide White Galvanized Steel Primer, 6-209
SW Galvite Paint, B50 WZ30
1 finish coat
PPG Speedhide Alkyd Lo-Sheen, 6-90
SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200
6. Other exposed galvanized metal.
1 primer coat
PPG Speedhide White Galvanized Steel Primer, 6-209
SW Galvite Paint, B50 WZ30
2 finish coat
PPG Speedhide Alkyd Lo-Sheen, 6-90
SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200

C. Interior Wood
1. Wood shelving and millwork.
1 primer coat
PPG Speedhide Quick-Drying Enamel Undercoater, 6-6
SW ProMar 200 Alkyd Enamel Undercoater, B49 W 200
1 finish coat
PPG Speedhide Interior Semi-Gloss Alkyd Enamel 6-1110 Series
SW ProMar 200 Alkyd Semi-Gloss Enamel, Series B34 W 200
2. Plywood walls.
1 primer coat
SW PrepRite ProBlock Interior-Exterior Latex Primer-Sealer, B51-600
2 finish coats
SW Proclassic Waterborne Acrylic Semi-Gloss Enamel, Series B31
3. Inside of cabinet drawers.
1 finish coat clear satin polyurethane
4. Hardwood millwork, doors, and trim.
1 coat stain; color as selected by Architect.
1 coat clear sanding sealer
2 coats clear satin polyurethane

D. Interior Concrete Masonry (At sound absorbing concrete masonry unit blocks, do not paint fibrous fillers)
1. Concrete masonry unit walls scheduled to have Epoxy Paint.
1 filler coat
PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
SW Heavy Duty Block Filler, B42 W 46
2 finish coats
PPG Auquapon WB Waterborne Gloss Epoxy coating 98-1 Series

SW Water-Based Catalyzed Epoxy, Series B70, Gloss Hardener

2. Concrete masonry unit walls in Mechanical Rooms.
   2 finish coats
   PPG Speedhide Interior Acrylic Latex Semi-Gloss Enamel, 6-510 Series
   SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200
3. Concrete masonry unit walls in Activity Room/Gymnasium
   1 filler coat
   PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
   SW Heavy Duty Block Filler, B42 W 46
   2 finish coats
   PPG Speedhide Interior Acrylic Latex Semi-Gloss Enamel, 6-510 Series
   SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200
4. Other concrete masonry unit walls.
   1 filler coat
   PPG Pitt-Glaze Int/Ext Latex Block Filler 16-90
   SW Heavy Duty Block Filler, B42 W 46
   2 finish coats
   PPG Speedhide Interior Acrylic Latex Semi-Gloss Enamel, 6-510 Series
   SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

E. 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
   3 finish coats
   PPG Speedhide Interior Flat Latex 6-70 Series
   SW ProMar 200 Latex Flat Wall Paint, Series B30 W 200
2. Gypsum board walls scheduled to have Epoxy Paint.
   1 primer coat - fine sanded texture
   SW ProMar 200 Latex Wall Primer, B28 W 200
   2 finish coats
   PPG Aquapon WB Waterborne Gloss Epoxy Coating 98-1 Series
   SW Water-Based Catalyzed Epoxy, Series B70, Gloss Hardener
3. Gypsum board walls above ceramic tile wainscot in corridors (where indicated).
   1 texture coat
   USG Multi-Purpose Texture - sprayed splatter medium-light finish texture
   PPG Speedhide Acrylic Texture Coating 4-50
   3 finish coats
   PPG Speedhide Interior Enamel Eggshell Latex 6-411 Series
   SW ProMar 200 Interior Latex Eg-Shel B20W2200 Series
4. All other 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 PrepRite ProBlock Interior-Exterior Latex Primer-Sealer, B51-600 or approved equivalent
   2 finish coats
   PPG Speedhide Interior Semi-Gloss Latex Enamel 6-510 Series
   SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

F. Interior Caulked Joints
1. Caulking
   2 finish coats
   PPG Speedhide Interior Semi-Gloss Latex Enamel 6-510 Series
   SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

G. Interior Plaster
1. Smooth plaster finish
   1 primer coat
   SW ProMar 200 Latex Wall Primer, B28 W 200
   2 finish coats
   PPG Aquapon WB Waterborne gloss Epoxy Coating 98-1 Series
   SW Water-Based Catalyzed Epoxy, Series B70, Gloss Hardener

H. Exterior Metal
1. Steel door frames and hollow metal doors.
1 primer coat
PPG Speedhide Int/Ext Rust Inhibitive Steel Primer 6-208 Series
SW Kromik Metal Primer E41N1
2 finish coats
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54
2. Steel pipe, conduit, hangers supports and brackets.
1 primer coat
PPG Speedhide Int/Ext Galvanized Steel Primer 6-209
SW Galvite Paint, B50 WZ30
1 finish coat
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54
3. Galvanized steel pipe handrails, railings, lintels, gates, metal fencing, ladders, ductwork, flashings, copings, roof hatches, tubular steel downspouts, galvanized gutters and downspouts, scuppers, ventilators, and louvers. (Reference test procedure for Passivators)
1 primer coat
PPG Speedhide Int/Ext Galvanized Steel Primer 6-209
SW Galvite Paint, B50 WZ30
2 finish coats
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54
4. Items of mechanical and electrical machinery and equipment, including mechanical and electrical equipment on the roof which are 12" above roof line and are not concealed by a screen.
1 finish coat
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54
5. Cast iron downspout boots.
1 primer coat
PPG Speedhide Int/Ext Rust Inhibitive Steel Primer 6-208 Series
SW Kem Kromik Metal Primer, B50 W 1
1 finish coat
PPG Int/Ext Industrial Gloss Alkyd Enamel 7-282 Series
SW Industrial Enamel, Series B54

I. Exterior Plaster
1. Cement plaster surfaces with integral color.
1 finish coat
PPG Speedhide Exterior Flat Acrylic Latex 6-610 Series
SW A-100 Exterior Flat, A6-100 Series

J. Exterior Wood
1. Siding, trim, doors, hardboard, miscellaneous wood
1 primer coat
SW A-100 Alkyd Exterior Wood Primer, Y24 W 20
PPG Speedhide Exterior Alkyd Wood Primer 6-9
2 finish coats
SW DTM Acrylic Semi-Gloss Coating, B66 Series
PPG Speedhide Exterior Semi-Gloss Acrylic Latex 6-900 Series

END OF SECTION

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.
2. Section 06 40 00 – Architectural Woodwork, display cases.

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 00 - SUBMITTAL PROCEDURES

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. Liquid Chalk Type Board (MB-01): Provide projectable porcelain enamel steel liquid chalk writing system, 4'-0" width 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. 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.

C. Frames and Trim: Provide extruded aluminum frames and trim. Finish for exposed trim surfaces shall be Architectural Class II AA-M21A31 natural anodic coating. Snap-on type trim is not acceptable. Product/manufacturer; one of the following:
Series 185; Claridge Products and Equipment, Inc.
HTS; Platinum Visual Systems™; a division of abc School Equipment

D. Joint Strips: H-shaped aluminum in single pieces for full height of boards.
1. At vertical joints within markerboards, color the strips to match the markerboards.
2. At vertical joints between markerboards and tackboards, strips shall be anodized aluminum.

E. 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."

F. Chalktroughs: Heavy tubular type of extruded aluminum with cast aluminum end caps, finished to match the markerboard frames.

G. Adhesive: Flash-proof type furnished or recommended by the manufacturer.

H. Exhibit Rails/Tack Strips: 3" wide extruded aluminum with Fabricork insert (color as selected by Architect) similar to Claridge No. EDR Exhibit Rail.

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:
      Elementary - 30"

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 14 00

IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast aluminum letters, room identification signs, and building dedication plaque.

1.2 SUBMITTALS

A. Submit in accordance with SECTION 01 33 00 - SUBMITTAL PROCEDURES.

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.

1.6 WARRANTY

A. Cast Aluminum Letters: Provide 5-year manufacturer's warranty.

PART 2 - PRODUCTS

2.1 CAST ALUMINUM LETTERS

A. Basis of Design: A.R.K. Ramos Mfg Signage Systems.

2.2 EXISTING EXTERIOR SIGNAGE TO BE RELOCATED: Relocate existing as indicated.

2.3 INTERIOR CAST ALUMINUM LETTERS

A. Provide interior cast aluminum letters at locations indicted.
   1. Type: Custom fabricated flush mounted cast aluminum Arial letters.
   2. Signage to read as indicated.

3. Letter height as shown by drawings. Install on 1” stand offs

B. Fabrication:
   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.
   3. Provide at least two points of attachment for each letter.

C. Pre-cleaning: Immerse the letters in hot alkaline cleaner to remove all contamination.

D. 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. Color shall be custom color as selected by Architect.

E. Clear Anodic Finish: Manufacturer’s standard clear anodic coating, 0.018 inch or thicker, over a satin (directionally textured) mechanical finish.

2.4 INTERIOR IDENTIFICATION GRAPHICS

A. Provide room identification signs as indicated in the attached INTERIOR IDENTIFICATION DEVICES SCHEDULE.

B. “Infinity” photopolymer plaque signs as manufactured by ASI Sign Systems, Inc. (8181 Jetstar Drive, Suite 100, Irving, Texas, 75063) or approved equivalent. Reference Drawings for locations.
   1. Sizes: As indicated on drawings
   2. Manufacture face panels utilizing an 1/8" integral photopolymer panel.
   3. Face panel tactile and Grade 2 Braille graphics shall be raised a minimum of 1/32".
   4. Treat the face panel to assure paint adhesion.
   5. Colors to be selected by Architect to meet ADA requirements for contrast.
   6. Characters and background of signs shall have eggshell, non-glare finish.
   7. Sign edges shall be painted to match background.
   8. Sign edges are to be smooth and free of saw marks and imperfections.
   9. Sign design shall be as indicated on drawings.
   10. Typeface shall be Helvetica Medium.
   11. Lettering shall be computer generated, accurately reproducing the letterform.
   12. Provide matching coverplate for signs mounted on glass.

2.5 EXTERIOR ROOM IDENTIFICATION GRAPHICS

A. Wall-mounted plaque signs as manufactured by ASI-Modulex or approved equivalent. (Phone 972.915.3800)
   1. Manufacture panels utilizing an aluminum panel with factory-applied oven hardened polyester finish.
   2. Face panel tactile and Grade 2 Braille graphics: LTV series vinyl graphics or direct UV-cured digitally printed graphics 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 font and size shall be per drawings.
   7. Lettering shall be computer generated, accurately reproducing the letterform.

2.6 BUILDING DEDICATION PLAQUE

A. Provide building dedication plaque as manufactured by A.R.K. Ramos Manufacturing Co., Inc. or approved equivalent.

B. Material: 1/4" thick stainless steel with paint-filled letters.
   1. Size: 18" x 18".
   2. Typeface: 1/2" x 3/4" Helvetica Medium, all caps, recessed copy.
   3. Text: 500 letters in 18 - 20 lines, as provided by Architect.
   4. Paint fill color: Selected by the Architect from the manufacturer's standard colors.
   5. Mirror buff finish of face and edges.
   6. Mounting: Provide 17-1/2" x 23-1/2" 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.

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.
      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. On painted gypsum wallboard or vinyl wallcovering, install room identification signs on backing plates with the "Tuff-bond" silicone adhesive furnished by the manufacturer (foam tape is not allowed).
      a. The backing plate shall be 1/8" thick and shall be the same size as the face panel.
      b. Screw the backing panel into molly bolts in the wall with two countersunk, flathead screws.
   3. 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.
   4. 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.
   5. Installation shall comply with ADA requirements.
   6. For signs mounted on glass, install matching coverplate on opposite side of glass and aligned with the sign.
   7. Overhead Panels: Install overhead panels in strict accordance with manufacturer's instructions.
   8. Install pressure sensitive vinyl letters plumb and square in strict compliance with manufacturer's instructions.

C. Building Dedication Plaque: Install building dedication plaque plumb and square in strict compliance with manufacturer's instructions.

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 22 39

FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manually operated, folding panel partition.

B. Related Work:
1. Section 05 50 00 - Metal Fabrications: Steel framing to support partition track.
2. Section 06 10 00 - Rough Carpentry: Wood blocking for partition track.
3. Section 09 72 16 - Vinyl-coated Fabric Wall Covering.

1.2 SUBMITTALS

A. Shop Drawings:
1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Submit shop drawings of partition layout. Include details of track, trolleys, and hardware. Indicate loading to be imposed in the supporting structure. Show all anchorage, accessory items, caulking, and finishes.

B. Product Data:
1. Submit data describing partition fabrication and installation, including hardware.
2. Submit finish data.
3. Submit laboratory acoustical performance test report, written by the test facility.

1.3 QUALITY ASSURANCE

A. Flame Spread Rating: Provide partitions with a Class "A" flame-spread rating when tested in accordance with ASTM E 84.

B. Provide demonstration of system as described in Part 3 below.

1.4 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.
1. Warranty period: Two (2) years.

PART 2 - PRODUCTS

2.1 PARTITIONS

A. Basis of Design Type: Modernfold "Acoustic-Seal" Paired Panel #932 manually operated, flat panels hinged in pairs, top supported with operable floor seals.
1. Products from the following Manufacturers equal to Basis of Design will be considered:
Kwik-Wall Company
Modernfold, Inc. (Dorma Kaba Group)

B. Sound Transmission Class (STC): STC rating shall be 45 when tested in accordance with ASTM E 90 for test in 14'-0" x 9'-0" opening.

C. Panel Construction:
1. Panels shall be 3.25" thick.
2. Panel Skin: Minimum 21 ga. roll-formed steel wrapping around the panel edge. Panel skins shall be lockformed and welded directly to the frame for unitized construction.
3. Panel Finish: Vinyl wall covering as selected by Architect from wall coverings as specified in SECTION 09 72 16 - VINYL-COATED FABRIC WALL COVERING.

D. Sound Seals:
1. Vertical: Interlocking sound seals in each panel edge.

2. Horizontal:
   a. Top closure seals shall be continuous multi-finger vinyl.
   b. Provide automatic operable bottom seal. Seal shall automatically drop as panels are positioned.

E. Provide #17 suspension system consisting of a continuous roll formed 11 ga. steel track. Each panel shall be supported by a all-steel 4-wheel ball bearing trolley.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Partitions shall be installed by the manufacturer's authorized factory trained representative and shall achieve the specified sound rating.
   1. Secure ceiling tracks to steel framing.
   2. Erect the partitions in a substantial manner to be straight and plumb.

3.2 ADJUST AND CLEAN

A. Adjust partitions and hardware, and leave in perfect working order. Clean exposed surfaces and leave free of defects.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance and user personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 10 26 13

CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Corner guards.

B. Related Sections:
1. Section 09 21 16 - Gypsum Board Assemblies: gypsum board walls.
2. Section 09 30 13 - Ceramic Tile.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 WARRANTY

A. Provide manufacturer’s limited lifetime warranty on Acrovyn corner guards.

PART 2 - PRODUCTS

2.1 CORNER GUARDS

A. Provide ACROVYN SM-20 by Construction Specialties (800.233.8493, www.c-sgroup.com). Surface mounted guards consisting of a continuous aluminum retainer with snap-on vinyl acrylic cover. Provide color matched end caps. Length as indicated on drawings. Color to be selected by Architect from manufacturer's full color range.
1. 4" x 3/4", .050" thick, 90°
2. 1-1/8" x 1-1/8", .075" thick, 90°
3. 2-1/2" x 2-1/2", .100" thick, 90°
4. 2-1/2" x 2-1/2", .100" thick, 135°
5. Height: 4' or 8' standard heights, or custom height
6. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawing shall be provided.
7. Finish: Surface shall be smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install corner guards in/on wall using manufacturer's anchoring devices and in compliance with manufacturer's instructions. Install true and plumb.
1. Drywall Hallways: Install screw on corner guards to wall securely using appropriate screws, as specified.

3.2 PROTECTION AND CLEANING

A. Protect surfaces from damage during construction.

B. At completion of the installation, clean all surfaces.

END OF SECTION

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SECTION 11 61 00

STAGE CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Front, side, and back setting stage curtains.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include detail sections of typical rigging elements; show anchors, hardware, operating equipment and other components.

B. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit manufacturer's color card, together with 12" square sample (any color).

1.3 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Firm with not less than 5-years of successful experience in fabrication and installation of stage curtains similar to those required for this project.

B. Flame Resistance Requirements: Provide stage curtains which are certified to be flame resistant in accordance with requirements of NFPA 701. Permanently attach label to curtain indicating whether curtain is permanently and inherently flame resistant, or whether it will require re-treatment after dry cleaning.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Main Platform Curtain:
   1. Fabric: 100% cotton 25 oz./linear yard, velour, color as selected by Architect.
   2. Lining: Yarn-dyed denim cloth of 100% cotton, woven in a wrap-faced twill; 54" minimum width, color as selected by Architect.
   3. Minimum requirements for flame resistance. Tag must be included on curtains:
      a. NFPA 701 – Small Scale
      b. NFPA 701 – Test Method#1
      c. NFPA 260A/UFAC Class 1
      d. ASTM E-84- Rated Class A(Class 1)

B. Side and Back Curtains at Platform: 100% Trevira polyester flame retardant 12 oz. per lineal yd. Color shall be Black.

C. Fire-Test-Response Characteristics: Provide stage curtains meeting the following requirements as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Flame-Propagation Resistance: Passes NFPA 701.
   2. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or is treated with flame-retardant chemicals and whether it requires retreatment after cleaning or after a designated time period of use.
   3. Permanently attach 12-inch- square swatch of same fabric and dye lot for each fabric of a curtain assembly to the back of assembly for use as fire-resistance test strip.

2.2 FABRICATION

A. Curtains, General: Provide not less than 50% additional fullness for curtains. Horizontal seams and fabric less than half-width are not permitted.
   1. Provide box pleats at 12" o.c., seams shall be 3½" and shall be attached to a 3½" jute webbing with no less than 3 rows of stitching.

2. Seams on leading edge shall be one-half width turn back, but no less than 18". Seams on offside shall be 4" to 6". Seams shall be free of puckers.
3. Bottom hem shall have tube 5" with concealed chain pocket carrying 2/0 tenso chain secured on both ends to prevent buckling. Bottom chain pocket shall be a minimum of 1" above bottom of hem.
4. Curtain shall be sewn with heavy-duty commercial thread to match fabric in color.
5. Grommets shall be #4 brass installed through fabric and webbing.
6. Curtain shall be secured to track by means of #10 bright zinc shook.

B. Front Curtain Tracks: Provide Besteel Model 170 two section track and assembly with a 2'-0" overlap in center as manufactured by Automatic Devices Co. (web site: www.automaticdevices.com).

C. Channel: No. 1700, 1 lb. 11 oz./linear ft.
1. Accessories: Provide as necessary.
   a. No. 1701 Single Carriers.
   b. No. 1703 Live end Pulleys.
   c. No. 1704 Dead end Pulleys.
   d. No. 1709 End Stops.
   e. No. 1728 Cord.
   f. No. 1702 Master Carriers.
   g. No. 2865 Tension Floor Pulleys.

D. Side and Back Curtain Tracks at Platform: Provide track and hanger assembly No. 113, as manufactured by Automatic Devices Co. (web site: www.automaticdevices.com) for a pull draw type curtain.
1. Aluminum track 16 gauge, 7/8"H x 1-1/4"W.
2. Provide accessories including splices, end caps, mounting spacers and radiused corners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install equipment in accordance with manufacturer's instructions and recommendations.

B. Install track (ceiling mounted) directly to top of pocket with maximum span of 18" between attachments.

C. Secure curtains to track carriers with track manufacturer's special heavy-duty "S" hooks or snap hooks.

END OF SECTION

SECTION 11 66 00

ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Athletic equipment.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include manufacturer's specifications, anchor details, and installation instructions for products.

C. Shop Drawings: Include drawings for fabrication and erection of equipment assemblies which are not fully described in manufacturer's data.

1.3 QUALITY ASSURANCE

A. The entire backstop structure shall conform to the current FIBA/NCAA rules and regulations governing basketball in force at time of installation.

1.4 WARRANTY

A. Provide Manufacturer’s Lifetime Warranty against breakage of backboard.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design Products as manufactured by Porter Athletic Equipment Co. Provide athletic equipment as manufactured by one of the following:
Draper Shade & Screen Co., Inc.
Performance Sports Systems, Inc.
Porter Athletic Equipment Co.

2.2 WALL PADS

A. Provide wall pads as manufactured by Porter Athletic Equipment Co. Vinyl covering shall be flame retardant and comply with UL-214. Vinyl covering shall be as selected by Architect from one of manufacturer's standard colors. Furnish all framing and associated hardware for complete and rigid installation.
1. Panels: No. 00560-0XX, panels shall be constructed of 2" Rebonded Foam, 2'-0" wide x 6'-0" high and cemented to 7/16" oriented strand board backing covered with flame retardant, vinyl coating fabric folded and stapled securely to back of oriented strand board. A 1" nailing margin shall be provided at top and bottom for securing panels to the wall.
2. “L” Shaped Panels: No. 90206026xx, panels shall be constructed in an “L” shape of 2" Rebonded Foam, 2'-0" wide x 6'-0" high and cemented to 7/16" oriented strand board backing covered with flame retardant, vinyl coating fabric folded and stapled securely to back of oriented strand board. A 1" nailing margin shall be provided at top and bottom for securing panels to the wall.

B. Protective Platform Columns Padding: Provide Model # 068 Vinyl Lace Up Cover Panel 6' Hook & Loop (12" x 72") as manufactured by Porter Athletic, Inc.(phone 888.277.7778 web site: www.porterathletic.com).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install athletic equipment and accessories in accord with the manufacturer's written instructions and recommendations.

1. Locate equipment accurately and install to be rigid and secure.
2. Install supplementary framing required for proper supporting of the backstops.
3. Mount backstops at proper height.
4. Wall Pads:
   a. Cut top of cove base to 3” allowing for wall pad installation 4” above finished floor.
   b. Mount wall pads 4” above finished floor per ASTM F2440.
   c. In addition to securing wall pads at top and bottom at nail strip, apply manufacturer recommended adhesive to back of pads to prevent them from bowing.
   d. Neatly make cutouts for switches, electrical outlets, and other items on wall and seal with matching vinyl fabric.
5. Upright sleeves must be absolutely plumb so that upright posts do not lean.
6. Volleyball Sleeves: Install sleeve and adapter per manufacturer's written instructions and recommendations. Floor plates shall finish flush with the finish court floor surface.

3.2 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

3.3 CLEANING AND PROTECTION

A. After completing athletic equipment installation, inspect components. Remove spots, dirt, and debris and tough up damaged shop-applied finishes according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions acceptable to manufacturer and installer that ensure athletic equipment is without damage or deterioration at time of substantial completion.

C. Replace athletic equipment and finishes that cannot be cleaned and repaired, in a manner acceptable to Architect, before time of substantial completion.

END OF SECTION

SECTION 22 02 00

BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to locations of piping, appurtenances, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.

B. The piping, fixture, and equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be provided by the Contractor at no additional cost to the owner.

D. Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified elsewhere. Prime and protective painting is included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

C. Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such times as the project is ready to receive the fixtures, equipment, pipe, valves, etc. - properly protected from incidental damage and weather damage.

C. Damaged fixtures, equipment, valves, pipe, or appurtenances shall be promptly removed from the site and new, undamaged items shall be provided in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise, water hammering, and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

E. Above ceiling piping and valves shall not be installed in direct contact with the work of other trades, including, but not limited to, suspended ceiling hanger wire.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards.

D. Such codes and standards shall include, but not necessarily be limited to:
1. American Standards Association, ASA.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
3. American Society of Mechanical Engineers, ASME.
4. American Society of Plumbing Engineers, ASPE.
5. American Society of Testing Materials, ASTM.

6. American Water Works Association, AWWA.
7. National Bureau of Standards, NBS.
8. National Fire Protection Association, NFPA.
9. UL, LLC (formerly Underwriters Laboratories).
10. FM Global.
11. International Energy Conservation Code, IECC.
12. International Fire Code.
13. International Fuel Gas Code.
14. International Plumbing Code.

E. Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.

F. When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2009 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to address any part of the work which the Drawings can fully convey in every particular and such omission shall not to relieve the Contractor from carrying out portions of work indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification indicates that products of similar design and equal construction from the list of acceptable manufacturers may be used, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outlined herein.

I. Where equipment other than that used in the design as specified or shown on the Drawings is provided (either from an acceptable manufacturer list or by submittal review), it shall be the responsibility of the Contractor to coordinate space requirements, building provisions and connection requirements with all trades bear any additional costs.

J. Where permission to use a substitution product, material, or method is granted by the Owner or Engineer in writing, the Contractor shall bear full responsibility for the implementation of that substitution. Specific responsibilities shall include, but shall not be limited to, the following:
   1. Verifying that the substituted item will fit in the space available. This shall include allowances for all code required clearances and manufacturer's maintenance and service clearances.
   2. The coordination and provision of all necessary supports, hangers, and appurtenances. Hanger spacing shall be adjusted accordingly and any additional hangers or supports required shall be provided.
   3. The coordination and provision of all necessary insulation, firestopping provisions, etc.
   4. Adherence to manufacturer's published installation recommendations.
   5. Adherence to requirements of the Authority Having Jurisdiction (AHJ) and provision of a code compliant installation.
   6. Changes to architectural, structural, electrical, mechanical, and plumbing requirements as a result of the substitution.
   7. Bearing any additional costs and time impact and providing any necessary redesign. The Owner will bear no such cost and make no time allowances.
   8. Coordination of plumbing and electrical requirements and utility provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
   1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
   2. An index page with a listing of all data included in the Submittal.
   3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
   4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
   5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
   6. Identification of each item of material or equipment matching that indicated on the Drawings.
   7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
   8. Additional information as required in other Sections of this Division.
   9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

C. Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
   1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not necessarily limited to, the following items:
1. Basic Materials.
2. Plumbing Fixtures and Valves.
3. Supports and Carriers.
4. Floor Drains, Roof Drains, and Cleanouts.
5. Interceptors/Traps (All Types).
6. Water Heaters and Boilers.
7. Expansion Tanks.
8. Water Softeners.
9. Water Treatment Equipment.
10. Water Filters.
11. Domestic Water Booster Pumps.
12. Fire Pumps and Jockey Pumps.
13. Storm, Sanitary, and Wastewater Pumps and Ejectors.
14. Fire Pump and Jockey Pump Controllers.
15. Domestic Water and Fire Protection Break Tanks.
16. Backflow Preventers.
17. Plumbing Piping.
18. Piping, Vessel, and Equipment Insulation.
19. Air Compressors and Air Dryers.
20. Expansion Fittings and Devices.
21. Variable Frequency Drives.
22. Noise and Vibration Controls.
23. Pipe and Equipment Hangers and Supports.
24. Plumbing Specialties.
25. Test, Adjust and Balance Reports.
26. Testing, Adjusting and Balancing Contractor Qualifications.
27. Coordination Drawings.

I. Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
      a. Wall locations and types.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm, sanitary sewer piping and plumbing piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.
   2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS
DATE:
(NAME OF GENERAL CONTRACTOR)
BY: _____
(SIGNATURE)
(NAME OF GENERAL CONTRACTOR)
BY: _____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include operational, trouble-shooting, and routine maintenance information for fixtures, specialties, and equipment.
1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.

6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.
12. Color coding charts for all painted equipment and conduit.
13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow 1/4” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel.

B. The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.

C. Before proceeding with the instruction of Owner’s Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.

D. Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

A. At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.

B. Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.

C. Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable only for minor superficial scratches, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

A. Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air compressors shall have parts and labor guarantees for a period of not less than five (5) years beyond the date of final acceptance.

E. Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data’s creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any re-use or modifications will be Contractor’s sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect’s written consent.
   1. It is agreed that “MEP” hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for “record purposes”, then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD’s. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner’s request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a “.rvt” or “.dwg” format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with “Buy American Act.”

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.

C. All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms, natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.

D. Access doors shall be as follows:
1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

B. Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.2 PLUMBING INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.
   4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
   10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
   11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.
   12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
   13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
   14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
   15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
   16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
   17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
   18. Identification of Plumbing Equipment:
      a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
      b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, removal, patching, replacement/repair as required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective Work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install fixtures, equipment, piping, and appurtenances in existing structures.
   6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
   7. Patch and replace/repair existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
   1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
   2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

B. Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.

E. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

F. Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

G. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.

H. Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.

I. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

J. Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

K. All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

L. Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

M. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

N. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

O. Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION

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SECTION 22 02 01

COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.

C. Submitting the contract drawings as coordination drawings will not be acceptable.

D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.

G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
      a. Wall and type locations.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm and sanitary sewer piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.
   2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.

H. Sequence of Coordination

Below is hierarchy of model elements and the sequencing by which the models will be coordinated.

1. Structural and Architectural model
2. Miscellaneous steel
3. Perform preliminary space allocation
4. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
5. Main and medium pressure ducts from the shaft out
6. Main graded plumbing lines and vents
7. Sprinkler mains and branches
8. Cold and hot water mains and branches
9. Lighting fixtures and plumbing fixtures
10. Smaller sized ducts and flex ducts
11. Smaller size cold water and hot water piping, flex ducts, etc.

I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J. The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K. By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION

SECTION 22 03 00

PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition of plumbing systems and components.

B. The drawings do not show all demolition work required. The contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.

C. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.2 RELATED SECTIONS

A. Alteration Project Procedures (may be present under Division 01).

B. Selective Demolition (may be present under Division 02).

1.3 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

A. The Owner will corporate with the Contractor, however, the following provisions must be observed:
1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.
2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

1.4 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, systems, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by his contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe, fittings, and hangers and/or line supports. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases of construction may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Project Administrator at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the owner's property. Repair, patch or replace as required any damage which might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Corporate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

J. All existing plumbing fixtures, pipe, materials, equipment, and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural "Demolition and/or Alteration" plans for actual location of walls, ceiling, etc., being removed and/or remodeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify measurements and piping arrangements are as shown on Drawings.

B. Verify that abandoned piping and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on energized equipment, use personnel experienced in such operations.

D. Existing Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

A. Demolish and extend existing plumbing work under related provisions of Division 1, Division 2, and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned piping to source of supply.

D. Remove exposed abandoned piping systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing installations which remain active. Modify installation or provide access panels as appropriate.

G. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Alteration Project Procedures Section.

3.6 REMOVAL OF MATERIALS

A. The contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

E. Certain work during the demolition phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner's Representative at least 72 hours in advance.

F. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch, or replace as required any damage which might occur as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction. Cooperate with the Owner and other trades in scheduling and performance of the work.

G. Include in the contract price all rerouting of existing conduits, wiring, outlet boxes, fixtures, etc., and the reconnecting of existing fixtures as necessitated by field conditions to allow the installation of the new systems. Furnish all temporary conduit, wiring, boxes, etc., as required to maintain lighting and power service for the existing areas with a minimum of interruption. Remove wire and conduit back to nearest accessible active junction box and extend to existing homeruns as required.

H. The contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

I. Where existing construction is removed to provide working and extension access to existing utilities, contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

J. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

END OF SECTION

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SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use. Provide electric motors, control panels, control and safety devices, and control wiring when specified or as required for proper operation of electrical systems associated with plumbing equipment and appurtenances.

B. WORK SPECIFIED ELSEWHERE:
1. Painting.
2. Power control wiring to motors and equipment.

1.3 WARRANTY

A. Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.5 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.
1. Baldor

2. Marathon
3. Leeson-Lincoln Electric
4. General Electric
5. Westinghouse

B. TEMPERATURE RATING: Provide insulation as follows:
1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.
1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
3. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.

E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F. FRAMES: U-frames 1.5 hp. and larger.

G. BEARINGS: Provide sealed re-greasable ball bearings; with top mounted zerc lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:
1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional horsepower motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures per applications as follows:
1. CONCEALED INDOOR: Open drip-proof (ODP).
2. EXPOSED INDOOR: Splash-proof.
3. OUTDOOR TYPICAL: Type III, totally enclosed fan-cooled (TEFC).
4. OUTDOOR WEATHER PROTECTED: Weather protected II (WPII).
5. HAZARDOUS LOCATIONS: Explosion-proof.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

NEMA Efficiency - 1800 RPM Synchronous Speed		
Motor Horsepower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	94.5
60	C	95.0
75	C	95.0
100 - 125	B	95.4
150 - 200	B	95.8

NEMA Efficiency - 1200 RPM Synchronous Speed		
Motor Horsepower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.2 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 22) shall be furnished under Division 22 and installed under Division 26 unless otherwise noted on the plans.
   1. Starters shall be provided for 3 phase motors 1 horsepower and greater.

B. Motor starters shall be furnished as follows.
   1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
   2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
   3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
   4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
   5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
   6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 22. Motor starter controls shall be mounted in the starter enclosure cover.
   7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
   8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
   9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
   10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers, fountains, or similar locations.

11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.
1. Siemens.
2. Square D.
3. General Electric.
4. Eaton.

2.3 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.1/B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Division 26.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.
1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors’ price shall include all items required as per manufacturer's requirements.

C. Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

D. Install rotating equipment in static and dynamic balance.

E. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

F. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fittings and items covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
1. Expansion joints and compensators.
2. Pipe loops, offsets, and swing joints.

1.3 RELATED WORK

A. Section 22 02 00 - Basic Materials and Methods for Plumbing

B. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

C. Section 22 10 00 - Plumbing Piping

1.4 REFERENCES

A. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.5 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:
1. Installation Temperature: 50 degrees F (10 degrees C).
2. Domestic Hot Water: 140 degrees F (60 degrees C).
3. Safety Factor: 30 percent.

C. Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer's literature for model series for different pipe sizes.

1.6 SUBMITTALS

A. Submit shop drawings under provisions of Division One.

B. Product Data:
1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

2. Pipe loops, offsets, and swing joints: Indicate temperature rise, developed lengths, pipe size, material expansion coefficient-allowable stress-modulus of elasticity, and final calculated amount of expansion. Indicate bend, loop, offset & return dimensions coinciding with the calculated expansion.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of expansion joints, fittings, anchors, and guides.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include adjustment instructions.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, project and handle products to site under provisions of Division One.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Bellows Type (Based on 4" Pipe):
1. Manufacturers:
a. VMC Group, Style EB
b. Triplex, Model Resistoflex R6905
c. Mercer Rubber Company, Style 803 or 805 (Mason Industries)
d. Metraflex

2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

B. Pre-manufactured Loop Type:
1. Manufacturers:
   a. Flexicraft Industries
   b. Metraflex MLS-UPC-80 series
2. Materials of construction: Copper custom 180 degrees bend (or 90 degree elbows with spool), copper 90 degree elbows for connections to piping, bronze hose and braid.
3. Certifications: NSF 61 lead-free compliant, IAPMO (UPC) approved.
4. Working Pressure: No less than 200 psi at 250 degrees F.
5. Allowable Movement: +/- 4 inches.
6. Labeled from the manufacturer and provided complete with attached support bracket and drain plug.
7. Size: Same as piping being served.
8. Installation: In strict accordance with manufacturer's recommendations, including support.
9. Application: Copper piping 4 inch and under.

2.2 ACCESSORIES

A. Pipe Alignment Guides to Direct Axial Movement:
1. Manufacturers:
   a. Triplex, Model Flexonics
   b. Metraflex
2. Welded steel construction bolt together two piece design, frame with four mounting holes, shop painted, spider type guide, exact style/model as necessary for bare or insulated pipe to match size and thickness as appropriate, 4 inch movement standard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. This shall include where piping crosses expansion joints in the building.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Division One.

B. Provide inspection services by manufacturer's representative for final installing and to certify the installation is in accordance with manufacturer's recommendations and expansion joints and accessories are performing satisfactorily.

END OF SECTION

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SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the items covered by this Section, with all appurtenances, ready for owner's use.

B. All plumbing piping shall be appropriately labeled.

C. Refer to Architectural Sections for any additional requirements.

1.3 RELATED WORK

A. Section 22 10 00 - Plumbing Piping

B. Section 22 07 19 - Plumbing Piping Insulation

1.4 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:
1. All valves shall be identified with a 1-1/2" diameter brass valve tag with stamped, black or red filled characters. Service designations shall be 1/4" letters and valve numbers shall be 1/2" numbers. Secure tags to valve handles by use of copper or Monel wire seals. For any services not identified below, contact Engineer in advance for approval. Service designations:
   a. Domestic cold water: DCW
   b. Domestic hot water: DHW
   c. Domestic hot water return: DHWR
   d. Natural gas: GAS
   e. Compressed air: AIR
2. All valves on the project shall be numbered sequentially, with valves for any one system and/or trade grouped together.
3. Valve tags are not required if the valve is located within 3'-0" of the equipment being served and the service is obvious.
4. Catalog a complete written record of all valves on the project, whether tagged or not. Include manufacturer, model number, size, service, system pressure (if like services with differing pressures are present on the project), location, valve tag data, and a description of the equipment/room/area served. Any valves which must be operated in sequence shall be indicated as such. Prepare a valve chart/schedule with all such information and include this chart/schedule in the project Operating and Maintenance Manual.

5. Mark all valve locations on the record drawings with appropriate identifying symbols or information to align with the above referenced valve chart/schedule. In addition to the O&M submission, provide the Owner with a digital copy (PDF format) of all such information in high-resolution, suitable for printing as full size drawings.
6. Tags and fastenings shall be manufactured by the Seton Nameplate Corporation or approved equal.
7. In addition to tags, all isolation valves serving emergency safety fixtures shall be provided with immediately adjacent clear and permanent signage indicating their purpose so as to avoid accidental shut-off.

B. Pipe Marking:
1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
2. All exterior visible piping shall be provided with pipe markers.
3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
   a. For pipes up to 6” provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
   b. For pipes 6” and larger provide flat snap-around markers installed using manufacturer’s heavy-duty nylon ties or stainless steel strapping.
   c. Markers shall indicate the pipe service, include flow directional arrows, and meet ASME A13.1.
5. Acceptable manufacturers:
   a. Seton Setmark Pipe Markers
   b. Brimar Industries Pipemarker System 1 Pipe Markers
   c. Brady Corporation
6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer’s installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
7. Markers shall be provided in accordance with ASME A13.1 requirements. Specific items indicated below are not intended as a substitute for this complete standard. Markers shall be provided:
   a. On both sides of each floor or wall penetration.
   b. On each side of each tee.
   c. On each side of each valve and/or valve group.
   d. On each side of each piece of equipment.
   e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.
   f. In congested areas, on each pipe at the point it enters and exits the area.
   g. At the point of connection to each piece of equipment and automatic control valve.
   h. Where they are readily visible to personnel from the point of normal approach.
   i. With letter height and length of color field according to the size of the pipe served.
   j. For non-potable water not less than once per room and at equally spaced intervals not to exceed 20 feet.
8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Sanitary Sewer	Green	Sanitary Sewer	White
	Green	Plumbing Vent	White
Storm Drain	Green	Storm Drain	White
	Green	Overflow	White
Domestic Water	Green	Domestic Cold Water	White
Domestic Hot Water	Green	Domestic Hot Water	White
Domestic Hot Water Return	Green	Domestic Hot Water Return	White
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White
Fuel Gas	Yellow	Natural Gas	Black

	Yellow	Propane Gas	Black
Diesel	Yellow	Diesel Oil	Black
Compressed Air	Blue	Compressed Air	White
Nitrogen	Orange	Nitrogen	Black
Carbon Dioxide	Orange	Carbon Dioxide	Black
Non-Potable Water	Yellow	Caution: Non-Potable Water, Do Not Drink	Black
Deionized Water	Green	Deionized Water	White
Reverse Osmosis Water	Green	R.O. Water	White
Acid Waste	Orange	Acid Waste	Black
		Acid Vent	Black

C. Pipe Painting:
1. Pipe painting shall be per the color schedule below or as directed by the Architect. Confirm all color selections with Architect prior to installation, in particular for exposed piping in publicly occupiable areas.
2. All exterior piping shall be painted.
3. All piping subject to corrosive conditions shall be painted. This shall include, but not necessarily be limited to: natatoriums, pool equipment rooms, chemical and metal processing areas, and animal pens.
4. All exposed piping shall be painted (including, but not limited to: piping in mechanical rooms, kitchens, and storage rooms).
5. Paint color schedule:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange
Fuel Gas (except for utility provider installed piping)	Yellow, unless specifically indicated/required otherwise by Architect or AHJ

2.2 EQUIPMENT IDENTIFICATION

A. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. All labeling equipment shall be installed per manufacturer’s printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items as required per manufacturers' requirements.

C. All piping to be painted shall be cleaned of rust, dirt, grease, oil and all other contaminants prior to painting. Provide primer if and as recommended by the paint manufacturer. Provide a quality polyamine epoxy paint over all surfaces of pipe.

END OF SECTION

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SECTION 22 07 16

PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Work specified elsewhere.
1. Basic materials and methods.
2. Piping systems.

1.3 REFERENCES

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.5 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.6 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

C. A sample quantity of each type insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

F. All insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

G. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

H. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Furnish and install piping insulation to:
1. Interior domestic hot water and hot water return piping.
2. Interior domestic cold water piping.
3. Interior domestic cold water piping located in exterior walls and to a point no less than 8'-0" inside the building.
4. Exterior domestic cold water piping.
5. Drain bodies and associated piping.
6. Condensate drainage piping.
7. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.
1. Painting.
2. Pipe hangers and supports.

D. For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment

C. Section 22 10 00 - Plumbing Piping

1.4 REFERENCES

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

D. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

E. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

H. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:
1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 PIPING INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

C. A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

E. All piping insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.2 APPROVED MANUFACTURERS

A. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

B. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Flexible closed-cell elastomeric thermal insulation by Armacell.

D. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

E. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products, Inc.

2.3 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: Provide pre-formed glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket.

B. EXTERIOR DOMESTIC WATER PIPE: Provide flexible closed-cell elastomeric thermal insulation in tubular form in accordance with ASTM C534/C534M, model "AP Armaflex" with secured aluminum jacketing, or preformed phenolic foam in accordance with ASTM C1126 with secured aluminum jacketing.

C. ROOF DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies with segmented fiberglass board in roll form with glass fibers adhered perpendicular to the vapor retarder facing. Provide insulation with factory applied FSK vapor retarder facing complying with ASTM C1136, Type II, IV, X. For associated horizontal piping, including first turn down to vertical conductor, provide glass mineral wool insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket.

D. CONDENSATE AND SIMILAR DRAINAGE:
1. Condensate piping: Provide flexible closed cell elastomeric thermal insulation in tubular form in accordance with ASTM C534/C534M, model "Armaflex Ultima", fire rated for use in environmental air plenums. Insulation is not required where piping is exposed on a roof.
2. Waste lines from water coolers and refrigerated drinking fountains to junction with main waste stacks: Insulate as described above.
3. Underside of floor drains and similar receptors receiving cooling coil condensate and the tailpieces, p-traps, and the associated piping to junction with main waste stacks: Insulate as described above.

E. ALUMINUM OR STAINLESS STEEL JACKETING: Utilize strap-on type jacketing, banding, and accessories. Provide pre-formed fitting covers for all elbows and tees.

F. ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed, complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. Pipes located outdoors, in tunnels or crawlspaces shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

D. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

E. Provide all piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.
1. Low temperature surfaces - Minimum Insulation Thickness
   a. Exposed exterior domestic water pipe: 1-1/2 inch
   b. Interior domestic cold water pipe: 1 inch
   c. Condensate drain lines: 3/4 inch
   d. Drains receiving condensate: 1 inch
   e. Concealed piping from roof drains: 1-1/2 inch
   f. Exposed piping from roof drains: 1 inch
2. Domestic Hot Water and Return Piping - Minimum Insulation Thickness
   a. Pipe sizes 1-1/4 inch and smaller with operating temperatures of 140°F or less: 1 inch
   b. Pipe sizes 1-1/2 inch and larger with operating temperatures of 140°F or less: 1-1/2 inch
   c. Pipe sizes 1-1/4 inch and smaller with operating temperatures greater than 140°F: 1-1/2 inch
   d. Pipe sizes 1-1/2 inch and larger with operating temperatures greater than 140°F: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor retarder jacket.

D. At hangers and supports, provide a high density foam insulation insert that extends 2” beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic. Also reference specific requirements in Section 22 05 29, Part 3 Execution.

3.3 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION

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SECTION 22 08 00

COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS

A. Section 01 91 00 - General Commissioning Requirements

B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

A. The commissioning of the plumbing system and associated controls shall be performed by an impartial technical firm hired by the owner. The commissioning provider shall be certified under one or more of the following certifications:
   1. CxA - Certified Commissioning Authority - ACG
      a. CBCP - Certified Building Commissioning Professional - AEE
      b. CCP - Certified Commissioning Professional - BCA
      c. CPMP - Certified Process Management Professional - ASHRAE
      d. BSC - Building System Commissioning Certification - NEBB

B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

A. Contractor: Responsibilities of the Contractor as related to the Commissioning Process include, but are not limited to the following:
   1. Facilitate coordination of Commissioning work by Commissioning authority.
   2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
   3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
   4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.
   5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
   6. Provide As-built drawings and documentation to facilitate Testing.
   7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
   8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
   9. Install systems and equipment in strict conformance with project specifications, manufacturer’s recommended installation procedures, and Pre-Functional Checklists.
   10. Provide data concerning performance, installation, and start-up of systems.
   11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
14. Provide qualified personnel to assist and participate in Commissioning.
15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
21. Coordinate and provide training of Owner's personnel.
22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority comments.
23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B. Subcontractors and vendors shall prepare and submit to Commissioning authority proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority

1.5 COMMISSIONING PLAN

A. Commissioning Process tasks and activities:
1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.
3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.
4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications. Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions (including all alarms). Controls system shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with the plans and specifications. Sequences shall be functionally tested to document they operate in accordance with plans and specifications.
5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.

6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B. Equipment to be tested
1. Energy Management and Control System interface with applicable plumbing system equipment.
2. Service water heating systems (100%).
3. Service water circulation equipment (100%).
4. Domestic water booster pumps (100%).

C. Testing functions and conditions
1. Verify shutdown of systems when scheduled.
2. Calibration of sensors
3. Confirm functionality of all specified sequences of operations.
4. Verify the functionality of all alarms.

D. Performance criteria
1. Water temperatures shall be within tolerances specified in the contract documents.
2. Water heating system “recovery” rates shall be within specified time frame.
3. Booster pump shall maintain system pressure within specified tolerance.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

A. Complete all phases of the work so the systems can be started, adjusted, balanced, tested, and otherwise tested.

B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C. Assist commissioning authority with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E. A minimum of 7 days prior to date of system startup, submit to Commissioning authority for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor's responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division's systems.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

C. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E. Sampling
1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
3. A common sampling strategy is the "xx% Sampling - yy% Failure Rule", defined by the following example.
   a. xx = the percent of the group of identical equipment to be included in each sample.
   b. yy = the percent of the sample that if failing, will require another sample to be tested.
   c. The example below describes a 20% Sampling - 10% Failure Rule.
   d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
   e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
   f. If 10% of the units in the second sample fail, test all remaining units in the whole group.

g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

F. Re-Testing And Failure To Remedy Deficiencies
1. Despite Contractor's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is Contractor's responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is Contractor's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
   a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor's control to resolve expeditiously.
   b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor's request.
   a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA's expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

G. Deferred Testing
1. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C. The training agenda (plan) shall include, at a minimum, the following elements:
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.

D. Commissioning authority shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning authority with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Sub-Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority copy of O&M manuals shall be submitted through Architect.

D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

A. Commissioning authority shall provide documentation of process as follows:
1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
1. Pipe and pipe fittings:
   a. Sanitary drainage piping system.
   b. Sub-surface drainage piping system.
   c. Domestic water piping system.
2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors
3. Valves
4. Excavation, Bedding, and Backfill

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment

D. Section 22 07 19 - Plumbing Piping Insulation

E. Section 22 11 12 - Domestic Water Piping - Cross-Linked Polyethylene (PEX) for Institutional Facilities

F. Section 22 11 19 - Plumbing Specialties

G. Section 22 30 00 - Plumbing Equipment

H. Section 22 40 00 - Plumbing Fixtures

1.4 REFERENCES

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

D. ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads; Current Edition.

E. ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2024.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

H. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

I. ASME B16.24 - Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500; 2021.

J. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.

K. ASME B16.39 - Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300; 2019.

L. ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings; 2013.

M. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; Current Edition.

N. ASME BPVC - Boiler and Pressure Vessel Code; 2023.

O. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

P. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.

Q. ASSE 1079 - Performance Requirements for Dielectric Pipe Unions; 2012.

R. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

S. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

T. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

U. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

V. ASTM A197/A197M - Standard Specification for Cupola Malleable Iron; Current Edition.

W. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2022a.

X. ASTM A403/A403M - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings; 2022b.

Y. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

Z. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars; 2022.

AA. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples; 2016 (Reapproved 2022).

BB. ASTM A865/A865M - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints; 2023.

CC. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

DD. ASTM B1 - Standard Specification for Hard-Drawn Copper Wire; 2013 (Reapproved 2018).

EE. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

FF. ASTM B16/B16M - Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines; 2019.

GG. ASTM B32 - Standard Specification for Solder Metal; 2020.

HH. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2020.

II. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

JJ. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.

KK. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

LL. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.

MM. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.

NN. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

OO. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

PP. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications; 2000 (Reapproved 2015).

QQ. ASTM C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems; 2018.

RR. ASTM C1460 - Standard Specification for Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground; 2017.

SS. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

TT. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

UU. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

VV. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

WW. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable; 2016.

XX. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.

YY. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2020.

ZZ. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

AAA. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings; 2022.

BBB. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2020.

CCC. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.

DDD. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

EEE. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

FFF. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2021a.

GGG. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

HHH. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

III. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019.

JJJ. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals; 2007.

KKK. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials; 2021.

LLL. ASTM D3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns; 2017 (Reapproved 2021).

MMM. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2017, with Editorial Revision (2019).

NNN. ASTM D4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials; 2012.

OOO. ASTM D5926 - Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems; 2015.

PPP. ASTM D6707/D6707M - Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications; 2016.

QQQ. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

RRR. ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus; 1992 (Reapproved 2018).

SSS. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

TTT. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

UUU. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).

VVV. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

WWW. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings; 2021.

XXX. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings; 2019.

YYY. ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems; 2016.

ZZZ. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

AAAA. ASTM F1548 - Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications; 2001.

BBBB. ASTM F1673 - Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems; 2010, with Editorial Revision (2021).

CCCC. ASTM F2618 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems; 2019.

DDDD. AWS A5.9/A5.9M - Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification; 2017.

EEEE. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

FFFF. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

GGGG. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

HHHH. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

IIII. AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings; 2019.

JJJJ. AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe; 2023.

KKKK. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.

LLLL. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; 2020.

MMMM. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.

NNNN. AWWA C651 - Disinfecting Water Mains; 2023.

OOOO. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.

PPPP. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

QQQQ. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.

RRRR. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

SSSS. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2022.

TTTT. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

UUUU. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

VVVV. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

WWWW. UL 1285 - Safety Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service; 2016.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D. Foreign pipe, fittings or valves are unacceptable.

E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

F. Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

G. Welders Certification: In accordance with ASME BPVC-IX.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data and video inspection report under provisions of Division One.

C. Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

D. Submit dimensioned detailed drawings and material specifications for pipe isolation and protection systems being provided for void form/carton form/void box installations.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

C. Include written report and digital video record of waste piping inspection.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary protective coating on cast iron and steel valves.

F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform work in accordance with plumbing and building codes having jurisdiction.

B. PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

C. Provide water pressure regulating valves:
1. At the service entry where incoming water supply pressure is greater than 70 psi.

2. Anywhere else in the distribution system where delivered water pressure is excessive relative to the fixture or equipment it serves, based on the fixture or equipment manufacturer's recommendations. Examples may include dish machines, booster heaters, food waste disposers, etc.

PART 2 - PRODUCTS

2.1 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.
1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.

2.2 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, NOT BURIED

A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.
1. Fittings: Cast iron, CISPI 301 or ASTM A888 drainage pattern.
2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
a. Tyler Pipe
b. Charlotte Pipe
c. AB&I Foundry
3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.
4. Joints: No hub heavy-duty, shielded, stainless steel couplings meeting ASTM C1540 and FM 1680 Class 1. Complete with minimum 304 stainless steel bands, tightening devices, and shield (minimum 0.015 shield thickness). ASTM C564 neoprene gasket. Made in the USA. Torque all clamps per manufacturer's recommendations. Acceptable manufacturers:
a. Husky SD 4000
b. Clamp-All 125

B. Copper Tubing: ASTM B306, DWV, for sizes 2" and smaller.
1. Fittings: ASME B16.23 cast copper alloy solder joint drainage fittings (DWV), or ASME B16.29, wrought copper and wrought copper alloy solder joint drainage fittings (DWV).
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead).
3. Joints between copper and cast iron pipe shall be made by way of copper soldered to a brass ferrule and the ferrule joined to the cast iron hub by a compression or caulked joint.

C. Brass Pipe: ASTM B43, chrome plated
1. Fittings: ASME B16.23 cast bronze, chrome plated.
2. Joints: In accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead) or as recommended by the manufacturer.
3. Applies to exposed piping applications (such as kitchens), wherever required by the prevailing code or by the Authority Having Jurisdiction.

D. Galvanized Steel Pipe: ASTM A53/A53M, schedule 40.
1. Fittings: ASME B16.3, ASTM A153/A153M hot-dip galvanized, ASTM A197/A197M malleable iron, minimum pressure class 150.
2. Joints: Threaded joints in accordance with the manufacturer’s installation instructions and ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads and shall be approved, insoluble in water, and non-toxic.
3. Applies only to limited installations such as services from submersible pumps and ejectors.

2.3 DOMESTIC WATER PIPING, WITHIN BUILDING, NOT BURIED

A. Copper Tubing: ASTM B88, Type L, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper alloy solder joint pressure fittings.

2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
3. Fittings and joints for pipe sizes 1/2" through 4” may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer’s approved press tools, kits, and jaws shall be used.
   a. EPDM o-rings shall be pre-installed and lubricated with NSF 61 listed lubricant.
   b. All installers of copper press-connect fittings shall be trained by the fitting manufacturer’s appointed representative and carry such credentials for the duration of the project.
   c. The fitting manufacturer’s representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer’s recommended installation practices.
   d. Acceptable system manufacturers: Viega only.
4. Rolled groove type fittings and joints shall be acceptable for copper pipe sizes 2-1/2 inch and larger, with all tools, couplings, adapters, fittings, and gaskets the product of a single system manufacturer.
   a. Fittings shall be cast bronze using lead-free alloys per ASTM B584 or copper wrought copper constructed to ASTM B75/B75M, compliant with NSF 61 for potable water service applications, and meet ASTM F1548.
   b. Couplings shall be epoxy/enamel (rust-inhibiting) coated ductile iron housings conforming to ASTM A536.
   c. Gaskets shall be EPDM for potable water, meeting ASTM F1476, and NSF 61 / NSF 372 certified for potable water service from 30 degrees to 180 degrees F.
   d. Acceptable system manufacturers: Victaulic, Shurjoint, Anvil Gruvlok.

B. CPVC Pipe: ASTM D1784 minimum cell classification 23447 for chlorinated polyvinyl chloride compounds, NSF 61 schedule 80 system, the product of a single manufacturer per ASTM F441/F441M.
   1. Fittings: ASTM F439 schedule 80 CPVC.
   2. Joints: solvent cement in accordance with manufacturer’s recommendations using ASTM F493 cement, in conjunction with ASTM F656 primer when recommended or when required by code.
   3. Compliance: Pipe material shall be tested to ASTM E84 and listed as having flame spread/smoke developed values not to exceed 25/50 and be approved by the local AHJ as acceptable for use in return air plenums.
   4. Acceptable system manufacturers:
      a. Spears Manufacturing Company EverTUFF
      b. Georg Fischer Harvel, LLC
   5. Where CPVC is specified for use in conjunction with copper piping, transitions to copper branch lines shall be provided as follows:
      a. A schedule 80 CPVC threaded bushing shall be provided at the CPVC fitting where the branch line/transition begins.
      b. A type L copper or brass threaded nipple shall be joined to the starting end of the copper branch line.
      c. The metallic threaded nipple shall be completely joined to the CPVC bushing.
      d. This shall apply to both vertical to horizontal and horizontal to horizontal transitions.

C. Stainless Steel Pipe: ASTM A312/A312M, schedule 10S, welded or seamless pipe, Type 304/L.
   1. Fittings: ASTM A403/A403M, wrought stainless steel butt-welding fittings of same Type and wall thickness as piping. Manufactured to the dimensional requirements of ASME B16.9. Chemical composition of the filler metal shall comply with AWS A5.9/A5.9M based on the alloy content of the piping.
   2. Alternatively, rolled grooving with grooved NSF approved stainless steel fittings of the same Type and wall thickness as the piping, complete with the couplings and gaskets of a single approved system manufacturer may be provided throughout.
      a. Such mechanical joints shall comply with ASTM F1476 and ASTM F1548.
      b. Acceptable system manufacturers: Victaulic, Anvil Gruvlok, Shurjoint.
   3. Joints between pipe and fittings and transition joints to other materials shall be made in accordance with the manufacturer’s installation instructions and using fittings, etc. designed for the specific transition.
   4. All pipe, fittings, and installation shall be compliant with NFPA 20, NSF 372, and shall be in accordance with the requirements of NSF 61.

2.4 ADAPTERS, TRANSITIONS, UNIONS, COUPLINGS, FLANGES, CONNECTORS

A. (Non-Acid Waste) Drainage Applications:
1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.
2. **Not buried:** For dissimilar piping not buried, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including cast iron to PVC transitions immediately adjacent to the building floor where piping below is buried.
   a. Husky 4200 or Cremco
   b. Fernco Proflex
3. **Buried, but NOT below building slab**: For dissimilar buried piping beyond the limits of building or readily accessible buried piping transitions in backwater valve pits, etc. Provide shear resistant .012" thick 300 series stainless steel shielded, **PVC gasketed** flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, to completely wrap the shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.
   a. Cremco
   b. Mission Rubber Company, LLC
   c. Fernco, Inc. Strong Back RC 1000 Series
4. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23 / ASME B16.29.

B. Domestic Water Applications:
1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.
2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable standards ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.24, ASME B16.50 ASME B16.50, ASME B1.20.1. All such appurtenances shall be for use in above ground potable water systems.
3. Buried to not buried transitions for water service entries:
   a. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.
   b. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.
4. Dielectric connections:
   a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.
   b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.
   c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C. General:
1. Unions for ferrous pipe shall be ASME B16.39 galvanized malleable iron, threaded, minimum pressure class 150.
2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.
3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53/A53M welded steel pipe nipples, threaded, meeting ASTM A733.
4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865/A865M.
5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.

6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16” thick pre-formed neoprene, typical.
7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer’s recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

2.5 GATE VALVES (IRON)

A. ASTM A126 cast iron bodied, class 125 gate valve with bolted bonnet, non-rising ASTM B16/B16M brass stem and packing gland, solid wedge, cast iron hand-wheel. Bronze wedge for sizes up through 6” and cast iron wedge with bronze bushing and wedge face rings for sizes 8” and larger.

B. Basis of design:
1. NIBCO T-619 (threaded) for sizes 2” through 4”.
2. NIBCO F-619 (flanged) for sizes 6” and larger.

C. Acceptable alternate manufacturers:
1. Apollo
2. Milwaukee

D. Applies only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.6 GATE VALVES (DUCTILE IRON)

A. Fusion bonded epoxy coated ASTM A536 ductile iron bodied, class 125 gate valve with bolted bonnet, non-rising Type 304 stainless steel stem, resilient wedge. End connections as suited for adjacent piping. Provide with square operating nut for extended handle operation or with hand-wheel as appropriate for depth of burial and access. Certified lead-free to NSF 61 / NSF 372 and AWWA C509 & AWWA C515 compliant (3” and larger).

B. Basis of design:
1. NIBCO 619 series for sizes 2” through 12”.

C. Applies to outdoor, buried domestic water main installations beyond 5 feet from the building edge. Not to be used inside of buildings.

2.7 BALL VALVES

A. All bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. Basis of design (bronze valves):
1. NIBCO T-585-66-LF (full port) for all sizes up through 2”.
2. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2” and 3”.

C. Valves 4” and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

D. Acceptable alternate manufacturers:
1. Apollo 77 CLF-A series (full port) for all sizes up through 2”.
2. Milwaukee UPBA-400S (full port) for all sizes up through 2”.
3. Apollo 77 CLF-A series (full port) for size 2-1/2” and Apollo 70LF-140 series (standard port) for 3”.
4. Milwaukee UPBA-100S (standard port) for sizes 2-1/2” and 3”.

E. Applies to domestic water system installations.

F. Provide valves complete with extended lever handles as required to accommodate insulation and full valve operation.

G. Provide valves complete with memory stop kit where used for balancing applications.

2.8 BUTTERFLY VALVES

A. ASTM A536 ductile iron bodied, (minimum) 200 psi lug type wafer style butterfly valve with ASTM A564 Type 316 series stainless steel stem, ASTM A743 stainless steel disc, and EPDM rubber seat/lining. Extended neck. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. Basis of design:
1. NIBCO LD-2000-3 (lever handle operated) for sizes 2-1/2" through 4".
2. NIBCO LD-2000-5 (manual gear operated) for sizes 6" and larger.
3. Install between standard ASME (minimum) class 125 flanges in accordance with manufacturer's recommendations.

C. Acceptable alternate manufacturers:
1. Apollo
2. Milwaukee ML234E (lever handle operated) and ML334E (manual gear operated).

D. Applies to domestic water system installations.

2.9 BUTTERFLY VALVES (GROOVED)

A. Grooved end, lead-free, copper alloy bodied, 300 psi butterfly valve with EPDM encapsulated ductile iron or aluminum bronze disc, EPDM seat/seal, stainless steel stem and trim, and extended neck. ANSI/NSF 61 certified for potable water systems. Lever handle operated for sizes 2-1/2" through 4" and manual gear operated with handwheel for sizes 6" and larger.

B. Acceptable manufacturers:
1. Victaulic 608N (cast brass body with aluminum bronze construction disc).
2. Shurjoint SJ-C300 (ASTM B584 bronze bodied).
3. Anvil Gruvlok Series 6700 CTS (ASTM B584 bronze bodied).

C. Applies only to domestic water system installations employing grooved copper joining systems, as specified elsewhere in this section. Manufacturers shall only be acceptable where their grooved systems are provided.

2.10 CHECK VALVES (BRONZE)

A. ASTM B62 / ASTM B584 bronze body and disc, minimum 200 psi (cold working pressure) Y-pattern horizontal swing type check valve with removable bronze bonnet, Type 300 series stainless steel nuts and hinge pin, and PTFE disc seat. Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. ASTM A126 cast iron bodied, (minimum) class 125 globe style spring loaded (silent) check valve with ASTM B584 bronze disc and seat. Flanged connections. Certified lead-free to NSF 61 / NSF 372 and suited to 200 degrees F.

C. Basis of design:
1. NIBCO T-413-Y-LF (Y-pattern swing type) for sizes up through 2".
2. NIBCO F-910-B-LF (globe style spring loaded type) for sizes 2-1/2" and larger.

D. Acceptable alternate manufacturers:
1. Apollo (for sizes up through 2")

E. Applies to domestic water system installations including associated pump discharge lines. Valves shall be suited for installation in both horizontal lines and vertical lines with upward flow, in accordance with manufacturer's recommendations.

2.11 CHECK VALVES (IRON)

A. ASTM A126 cast iron bodied, (minimum) class 125 conventional horizontal swing type check valve with bronze, cast or ductile iron disc. 200 psi cold working pressure. Threaded or flanged connections.

B. Basis of design:
1. NIBCO T-918-B (threaded connections) for sizes 2" through 4".
2. NIBCO F-918-B (flanged connections) for sizes 6" and larger.

C. Acceptable alternate manufacturers:
1. Apollo (flanged in all sizes)
2. Milwaukee F-2974A (flanged in all sizes)

D. Applies only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.12 PRESSURE REGULATING VALVES (PRV'S)

A. ASTM B62 / ASTM B584 bronze bodied direct acting, ASSE 1003 single diaphragm type pressure regulating valve with removable bronze bonnet, in-line stainless steel strainer and spring, and FDA approved EPDM seat disc and Buna-N diaphragm. Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. NSF 61 epoxy coated ductile iron bodied pilot-operated globe style pressure regulating valve assembly. Complete with low-flow bypass and stainless steel, bronze, and copper trim and fittings. NSF 61 EPDM seat disc and diaphragm. Threaded or flanged connections. Suited to 180 degrees F.

C. Basis of design:
1. Apollo PRH-LF (36HLF series) for direct acting valves, sizes up through 3". Provide with y-strainer. Provide threaded up through 2" and flanged for larger sizes.
2. Apollo A127-LF series for pilot operated valves, sizes 1-1/4" through 4".

D. Acceptable alternate manufacturers:
1. Cla-Val
2. Victaulic (pilot-operated valves)

E. PRV's shall automatically reduce inlet pressure to a steady lower downstream pressure, regardless of changing flow rate. Provide complete with inlet strainer, inlet and outlet pressure gauges, isolation valves, and unions. Provide bypass line around assembly with normally closed valve.

F. Point of use PRV's serving individual equipment items shall not be required to have a bypass.

2.13 BALANCING VALVES

A. Self-contained, fully automatic thermally actuated balancing valve shall continuously adjust flow to maintain the desired domestic hot water temperature within the branch line, regardless of system operating pressure. Valve shall modulate between open and closed position within a 10 degrees F range. The valve set-point (closing temperature) shall be the hot water system supply temperature. Valve body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless. Rated for 200 psi maximum working pressure and no less than 250 degrees F maximum working temperature. Lead-free NSF 372 and NSF 61 compliant. Threaded connections.

B. Basis of design:

1. ThermOmegaTech Circuit Solver, sizes 1/2" through 2”. Provide a union and ball type shutoff valve on both sides of the balancing valve.
2. ThermOmegaTech Circuit Solver with integrated union (CSU) assembly, sizes 1/2" and 3/4". Balancing valve assembly shall come complete with union body and ball type shutoff valves on both sides.
3. Provide complete with an integral check valve from the manufacturer, positioned after the balancing valve. For balancing valves not available with an integral check valve as part of the manufacturer's assembly, ensure to provide a lead-free swing type check valve on the downstream side of the balancing valve component.

C. Applies to circulated domestic hot water system installations including multi-branch parallel piping circuits and single-loop piping circuits.
1. Provide balancing valve at end of each domestic hot water supply line (after last fixture served) just prior to the hot water return line, as indicated on Drawings and in accordance with manufacturer’s installation recommendations.
2. Provide a pipe tee or elbow with bushing as appropriate, 3/4" threaded thermowell, and bi-metal adjustable angle 3 inch dial thermometer upstream of each balancing valve. Thermowell stem length and thermometer temperature probe length to be suited for pipe size, insulation thickness, and to ensure clearance for maintenance access and easy viewing of thermometer. Trerice bimetal/sensor, threaded-stepped shank thermowell (style 76) of lead-free brass (PBF) material. Trerice Model B836 thermometer with 300 stainless steel case and stem, hermetically sealed, double strength glass windowed, aluminum white-faced dial, complete with external reset and 0 to 200 degrees F range. Thermowell and thermometer face to be oriented upright for readability.

PART 3 - EXECUTION

3.1 EXCAVATION, BEDDING AND BACKFILL

A. This section shall apply for the excavation, bedding, and backfill of all buried piping unless specifically noted otherwise. All work shall be coordinated with any job site subsurface drainage/dewatering and adjusted accordingly.

B. Establish elevations of buried piping outside the building to ensure the following:
1. Not less than 2 feet of cover, or not less than maximum depth of frost penetration, whichever is the greater.
2. For water lines intended for fire protection service, the depth of cover shall be:
   a. Not less than 2’-6” in those locations where frost is not a factor.
   b. Not less than 1’-0” below the frost line for the locality.
   c. Not less than 3’-0” for piping under driveways.
   d. Not less than 1’-0” below the bottom of the building foundation/footers.
   e. In full compliance with the requirements of NFPA 13 and NFPA 24.

C. Excavation:
1. Excavate trenches for underground piping to the required depths.
2. The bottom of the trench or excavation shall be cut to a uniform grade.
3. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp to existing density.
4. Coordinate alignment of pipe trenches to avoid obstructions. Ensure that proposed routing of pipe will not interfere with building foundation before any trenching has begun. Should conflicts occur, contact Architect/Engineer before proceeding.
5. Should any sleeving of the building foundation be required, this shall be provided as directed by the structural engineer of record AND in accordance with the prevailing code, but in no case shall the sleeve be any less than two (2) pipe sizes greater than the pipe it serves.

D. Bedding and Backfill:
1. Backfill shall not be placed until the piping has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades indicated on drawings. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe. Provide select fill up to finished surface or grade, unless indicated otherwise by project geotechnical report or specified otherwise in Division 02.

2. Compacting Backfill: Place material in uniform layers of 8 inches maximum, loose measure and compact to not less than 95% of maximum soil density as determined by ASTM D698 Standard Proctor.
3. Restoration: Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks and similar areas, to a condition equal to the adjacent undisturbed earth and restore surface of the area to the condition existing prior to trenching or excavating operation.
4. A clay fill “trench plug” extending 3 feet inside the building line and 5 feet outside the building line shall be placed to completely surround utility lines passing beneath the foundation and grade beam. The materials shall consist of on-site soils with a plasticity index (PI) between 30 and 40 percent compacted to at least 95 percent of the Standard Proctor and maximum dry density as determined by ASTM D698.

E. Cement Stabilized Sand:
1. Materials:
   a. Cement shall be Type I Portland cement conforming to ASTM C150/C150M.
   b. Sand shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33/C33M and free of organic matter and deleterious substances.
   c. Water shall be potable and free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94/C94M.
2. Mixture:
   a. Product shall consist of not less than 1.5 sacks of Portland cement per ton of dry sand.
   b. Mixture shall contain sufficient water to hydrate the cement and be thoroughly mixed in a pugmill type mixer.

F. For water lines (including In-Building Risers) intended for fire protection service, provide joint restraints by way of concrete thrust blocks in accordance with the requirements of NFPA 13 and NFPA 24.

G. Aggressive Soil Conditions: Soil shall be considered aggressive and protection of buried metallic piping shall be provided as specified if any of the following situations exist:
1. Conditions are identified as such by the project geotechnical report or project geotechnical engineer.
2. The soil environment is a landfill area, swamp, marsh, polluted river bottom, cinder bed, or has alkaline soils.
3. A score of ten or higher is tallied when applying the soil assessment tool detailed in Appendix A of AWWA C105/A21.5. An excerpt of this evaluation procedure is provided below for reference but is not intended as a substitute for the complete and latest Standard:

NUMERICAL CORROSIVITY SCALE	
Soil Parameter	**Assigned Points**
Resistivity (ohm-cm)	
< 700	10
700 - 1,000	8
1,000 - 1,200	5
1,200 - 1,500	2
1,500 - 2,000	1
> 2,000	0
pH	
0 - 2	5
2 - 4	3
4 - 6.5	0
6.5 - 7.5	0
7.5 - 8.5	0
> 8.5	3
Redox Potential (mV)	
> 100	0
50 - 100	3.5
0 - 50	4
< 0	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage continuously wet	2
Fair drainage generally moist	1
Good drainage generally dry	0

H. Building Sub-Surface Drainage System Installation:
1. The following general installation provisions are intended to complement, not conflict with, the recommendations of the project geotechnical report. In the event of a conflict with or more stringent requirements in this report, it shall govern the installation of this system.
2. Such pipe shall be bedded and surrounded by filter material of suitable gradation. Refer to the recommendations of the project geotechnical report.
3. Drainage system shall be provided directly behind and at the bottom of buried walls, within granular drainage medium as specified and in accordance with the latest project geotechnical report.

I. Crawlspace Installations
1. Where piping will be installed in such spaces, its installation shall be fully coordinated with the building slab/floor construction and/or existing conditions.
2. Routing and installation shall be coordinated so that all piping is provided within the available clear space above the crawlspace “floor”, with uniform slope as required per code and/or as indicated on the Drawings.
3. Rods, hangers, inserts/anchors and hardware shall be provided to properly support the piping to prevent sagging, misalignment, stress on joints or fittings, and any deviation in required slope. Refer to other paragraphs in this Section for additional requirements for suspended pipe installation.
4. All rods, hangers, and hardware in crawlspaces shall be provided hot-dipped galvanized or stainless steel. Refer to Section 22 05 29 for additional information on Hanger and Supports.

5. All waste piping p-traps and all water piping located in such environments shall be insulated. Refer to Section 22 07 19 for additional information on Pipe Insulation.
6. **Unless specifically noted otherwise, reference the Articles above addressing piping "NOT BURIED" for the pipe material to be provided within crawlspaces, for each plumbing system.**

J. Void Form/Carton Form/Void Box Installations
1. Where piping will be installed in a such a setting, steps shall be taken to isolate and protect the piping from expansive soil conditions. This work shall be fully coordinated with the building slab/floor construction, the project geotechnical report, and the structural Drawings and specifications. The most stringent conditions/recommendations shall govern.
2. All piping below slab shall be supported by an approved suspended system.
3. System structure:
   a. Shall provide a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes and fittings, including all imposed loads, throughout the construction process.
   b. The system shall be designed to have the ability to temporarily position and suspend the lateral pipes and fittings to the required height/depth and slope until permanently anchored to the overhead structural slab via the securing hanger system. The open, underground system will then remain independent from the securing hangers.
   c. The open space of the system beneath the structural slab shall be designed to receive the infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact with the soil, the uplifting soil pressure will become separate and allow the lateral pipes and fittings to be totally independent from the system.
4. System components:
   a. The system shall have waterproof components related to its intended performance.
   b. The system must maintain its structural integrity in all humid environments.
   c. The system must have industry-proven performance in any and all inclement conditions.
   d. The system shall be able to perform if and when submerged in water.
   e. All independent components not included in the system shall comply with the project specifications in order to achieve the intended results of the designed system.
   f. All vertical all-thread rod must have a component secured toward the top end and be permanently affixed into the concrete slab in order to maintain the required elevations.
   g. All system components, excluding all-thread rod, nuts/washers, shall be furnished by the designed, system manufacturer.
   h. Galvanized steel all thread-rod and hardware shall be provided and these materials shall be coordinated with the system manufacturer’s related components.
   i. The system shall be installed per the manufacturer’s requirements and recommendations.
5. Submittals: The exact system to be provided, complete with dimensioned detailed drawings and material specifications, shall be submitted for review by the Architect, MEP engineer, structural engineer, and project geo-technical engineer.
6. Acceptable System Manufacturers:
   a. SuperVoid Systems, LLC
   b. Void Form Products, Inc.
   c. Other pre-approved system providers.
7. Manufacturer Training: The system manufacturer shall provide on-site training, support, and guidance to the Contractor regarding the recommended installation of their products.

K. Pipe Penetrations of Buried Exterior Walls or Foundations
1. Unless specifically indicated otherwise on the Drawings, each pipe penetration shall be provided with a schedule 40 steel pipe sleeve no less than two (2) pipe sizes larger than pipe itself.
2. At each penetration provide GPT Industries (“Thunderline”) Link Seal Modular Seal LS series. The exact model shall be as required for the pipe material, pipe size, and sleeve length for the penetration. Provide complete with EPDM sealing element and model “C” zinc coated carbon steel hardware.

3.2 INSTALLATION

A. General requirements for piping:
1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove any scale, oil and dirt, on inside and outside, before assembly.
3. Prepare piping connections to equipment with flanges or unions.

4. Confirm pipe placement, depth/elevation, and flow lines prior to any installation.

B. General requirements for valves:
1. Install valves with stems upright or horizontal, not inverted.
2. Valves shall be line-sized unless specifically noted otherwise.
3. Provide clearance for installation of insulation and access to valves and operable fittings. Valves installed beyond reasonable reach shall be provided with a chain operator.
4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.
5. Gate valves installed buried shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top of cover and shall be set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

C. Install all materials in accordance with the manufacturer's published instructions.

D. Unburied piping inside the building shall be installed concealed, out of public view wherever possible (above ceilings, inside walls and chases, within casework, etc.). This requirement shall not apply to fixture supplies & stops and chrome plated tubular brass drainage piping.

E. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chrome plated.

F. Provide non-conducting dielectric connections wherever joining dissimilar metals.

G. Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

H. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

I. Group piping whenever practical at common elevations.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide encasement for and support for utility meters in accordance with the requirements of utility companies.

M. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

N. Maintain uniformity in the installation of piping materials and joining methods. Do not mix material types.

O. Where connecting new underground sanitary, storm, or vent piping to existing piping of dissimilar material, provide suitable mechanical transition fittings complete with corrosion protection for metallic elements. Chase Construction Products Tapecoat H35 or approved equivalent and a final coat of coal tar to completely cover the transition.

P. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

Q. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

R. General requirements for cast iron piping installation:

1. Install all pipe and fittings in accordance with published recommendations from the manufacturer and the Cast Iron Soil Pipe Institute (CISPI). Specific items referenced below are not intended as a substitute for the complete and latest recommendations.
2. Install bell and spigot type pipe with bell end upstream.
3. Above ground horizontal pipe (suspended) shall:
   a. Be supported at no less than at every joint, and within 18” of the hub or coupling.
   b. Be maintained in alignment. Sagging or grade reversal shall be unacceptable.
   c. Be supported at terminal ends of all runs or branches and at each change of direction or alignment.
   d. Have all closet bends, traps, trap arms, and similar branches firmly secured.
   e. Be braced to prevent movement or joint separation.
   f. Be provided with suitable sway bracing (such as clamps, rods, and hardware) where pipe and fittings are suspended in excess of 18” by means of non-rigid hangers.
4. Above ground vertical pipe shall:
   a. Be secured at each stack base.
   b. Be secured at each floor and riser clamps shall be provided on no greater than 15’-0” intervals.
   c. Be adequately supported to keep the system (pipe and contents) in alignment.
5. Provide seismic restraints in seismically active areas, whether specifically required by the prevailing code or not.

S. For all buried non-metallic piping outside the building, provide minimum 14 AWG solid copper tracer wire (ASTM B1, ASTM B3) with high molecular weight polyethylene insulation (HMWPE) per ASTM D1248. Wire shall be suited for direct bury applications to facilitate the detection and tracing of underground piping systems. THHN wire and other such nylon jacketing shall not be allowed. Insulation color shall be provided per the particular utility, in accordance with the American Public Works Association (APWA) uniform color code. Provide corrosion proof wire connectors with twist locking design and protective dielectric sealant. Copperhead Industries, LLC Snakebite or pre-approved equivalent. Tracer wire shall be placed in the same orientation as the installed pipe and laid six inches directly above the piping. One end of the tracer wire shall be brought aboveground at a building wall or riser for easy identification.

T. PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

U. Installations of buried thermoplastic piping systems shall be in strict conformity with the manufacturer’s published instructions and the requirements of ASTM D2321 (gravity pipe) and ASTM D2774 (pressure pipe).

V. Installation of thermoplastic piping systems which are not buried shall be in accordance with the manufacturer’s recommendations. The specific items indicated below are not intended as a substitute for the complete and latest manufacturer’s recommendations.
   1. Hangers and supports shall not compress, distort, cut, or abrade the piping. Nor shall they force the pipe and fittings into position.
   2. Piping shall be supported at intervals sufficiently close to maintain pipe alignment and to prevent any sagging or grade reversal. System maximum operating temperature will determine support spacing.
   3. Piping shall be supported at all branch ends and at all changes of direction, as close as practical to the fitting to avoid introducing excessive torsional stresses into the system.
   4. Directly support (or if need be, immediately adjacent to) concentrated loads in the system, such as valves and other appurtenances.
   5. Allowances must be made for thermal expansion and contraction of the piping system where temperature fluctuations can reasonably be expected to produce such movement. Provide and place hangers accordingly so as not to restrict.
   6. Plastic piping systems shall not be placed alongside steam or other high temperature pipe lines or other high temperature objects.
   7. Drainage piping shall be supported at trap arms as close as possible to the trap and all closet bends shall be supported and braced.

W. Installation of solvent cement joints for PVC and CPVC piping shall be in strict conformity with the requirements of ASTM D2855 and manufacturer’s published instructions.

X. Provide approved heavy duty transition coupling at each transition from cast iron pipe not buried to buried PVC pipe as specified elsewhere in this section. Transition shall be made as close as possible to the floor for sanitary DWV piping systems and at test tee “minimum 12 inches A.F.F.” for storm drainage piping. Support vertical cast iron pipe from floor anchors using riser clamp and galvanized all thread rod as specified in Section 22 05 29.

Y. All grooved system tools and components (couplings, adapters, fittings, gaskets, and specialties) shall be the product of a single domestic system manufacturer.

Z. Grooved pipe system manufacturer shall provide on-site training for contractor’s field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products at no additional cost to the owner.

3.3 APPLICATION

A. Provide union downstream of all valves at equipment or apparatus connections.

B. Provide unions downstream of all threaded isolation valves in the domestic water system to facilitate any future valve replacement.

C. Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

D. Provide approved isolation valves for shut-off and to isolate all equipment items and distinct parts of systems. Isolation valves shall be provided for both hot and cold water in locations including, but not necessarily limited to, the following:
1. At the domestic water service entry.
2. At each wing of the building.
3. At each floor for each domestic water tap branching off from a vertical riser.
4. At each domestic water branch line capped for future use.
5. At each restroom or restroom group.
6. At each hose bibb, wall hydrant, roof hydrant, hose reel, and trap primer device (except for flush valve or tailpiece type trap primer devices).
7. At each domestic water branch line within 24” of the corresponding main.
8. At each plumbing fixture not otherwise served by a localized fixture group isolation valve.
9. At each kitchen or similar food service space.

E. Each plumbing water rough-in stub out shall be fitted with a supply stop.

F. Valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service, the valve handle shall be equipped with adjustable memory stop device.

G. Provide non-slam type check valves on discharge lines from all water pumps. Install at a minimum length of 5 times the pipe diameter from the pump and in accordance with manufacturer’s installation recommendations.

3.4 ERECTION TOLERANCES

A. All gravity drainage piping shall be provided at a uniform and continuous slope in accordance with the prevailing plumbing code and as described below. If any of the criteria below conflicts with the prevailing code then the code requirements shall govern:
1. Gravity piping 3" and smaller shall be provided at no less than 1/4" per foot slope.
2. Gravity piping 4" and larger shall be provided at no less than 1/8" per foot slope.
3. Where the code allows for a shallower slope than indicated above, this shall be allowed if required per project conditions.
4. Where the code requires a steeper slope than inidcated above (such as for grease waste piping) than such requirements shall control.

B. All vent and branch vent pipes shall be graded and connected as to drip back by gravity to the drainage pipe it serves. A slope of 1 inch per 40 feet will suffice for this requirement, subject to the approval of the local Authority Having Jurisdiction.

C. Slope all horizontal water piping with uniform pitch of 1/8 inch per 10 feet to low points to allow for complete system drainage. For long runs, where constant pitch cannot be maintained, provide intermediate low points and rise up again from such locations. Slope horizontal branches back to mains or risers. Provide clearly identified supplementary drain valves where hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.7 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.8 VIDEO INSPECTION AND DOCUMENTATION

A. It shall be the responsibility of the plumbing contractor to retain the services of a qualified, independent company (other than the installing plumbing contractor) with no less than ten (10) years of experience in digital video camera inspection/investigation of plumbing drainage waste and vent lines for commercial/institutional building projects.

B. The independent company shall perform a complete video camera inspection of all waste piping buried inside the building. This shall include sanitary waste and any specialty waste (grease waste, oily waste, etc.) systems and shall extend from the building all the way to any associated outdoor traps/interceptors.

C. The independent company shall create a permanent digital video record of their inspection with accompanying definitive identification (audio or visual) to indicate different systems and different areas of the systems inspected.

D. The independent company shall prepare a comprehensive written report including, but not necessarily limited to, the following:
1. Complete company contact information.
2. Project name and address.
3. Date(s), time(s), and conditions during the inspection(s).
4. Name(s) of the operator(s) performing the inspection(s).
5. A general summary of the inspection results.
6. A written description of any and all material and/or installation deficiencies or irregularities found, with accompanying pictorial documentation. This shall include conditions such as:
    a. Deformed or damaged piping
    b. Full or partial blockage of piping
    c. Deleterious material or debris within the piping
    d. Slope deficiencies (inadequate, inconsistent, or absent slope)
    e. Valleys or “dips” in the piping
    f. Improper fittings in the piping including reductions in pipe size in the direction of flow

E. The written report shall be submitted under this Section but separately from other submittals of this Section. This shall occur immediately prior to substantial completion.

F. The written report and the digital video record (DVD or USB flash drive) shall also be submitted as part of the Project Record Documents.

3.9 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G. Domestic Water: Pressure test at one and one half times the normal working pressure or 125 psig, whichever is the greater, for 24 hours.

H. Sanitary Soil, Waste and Vents and Storm Sewer:
1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.
3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.10 COMPLETE FUNCTIONING OF WORK

A. All work reasonably implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division, unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

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SECTION 22 11 19

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the specialties covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
1. Hose Bibbs and Hydrants
2. Backflow Preventers
3. Water Hammer Arresters
4. Strainers and Filters
5. Thermostatic Mixing Valves
6. Digital Mixing Valves
7. Floor Drains and Floor Sinks
8. Cleanouts
9. Trap Primers
10. Interceptors and Separators
11. Roof Drains and Overflow Nozzles

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 10 00 - Plumbing Piping

C. Section 22 30 00 - Plumbing Equipment

D. Section 22 40 00 - Plumbing Fixtures

1.4 REFERENCES

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.1070 - Performance requirements for water temperature limiting devices; 2020.

C. ASSE 1010 - Performance Requirements for Water Hammer Arresters; 2004.

D. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems; 2009.

E. ASSE 1060 - Performance Requirements for Outdoor Enclosures for Fluid Conveying Components; 2017 (Reaffirmed 2021).

F. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves; 2020.

G. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

H. ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment; 2012.

I. NSF 372 - Drinking Water System Components - Lead Content; 2022.

J. PDI-WH 201 - Water Hammer Arresters; 2017.

K. ASME A112.6.7 - Sanitary Floor Sinks

L. ASSE 1057 - Performance Requirements for Freeze Resistant Sanitary Yard Hydrants with Backflow Protection

M. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves

N. AWWA C510 - Standard for Double Check Valve Backflow Prevention Assembly

O. NSF 61 - Drinking Water System Components - Health Effects

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit shop drawings and product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment and backflow preventers.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Operation Data: Indicate frequency of treatment required for interceptors and separators.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two loose keys for hose bibbs and hydrants and spare hose end vacuum breakers.

1.11 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 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.

1.12 REGULATORY REQUIREMENTS

A. Conform to applicable codes for the provision and installation of all required backflow prevention devices.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

C. Provide backflow prevention assembly test and maintenance report for all devices. A printed and signed form by the licensed tester that performed the work shall be provided both to the Owner and to the Public Water System in accordance with TCEQ (Texas Commission on Environmental Quality) requirements.

PART 2 - PRODUCTS

2.1 WATER HAMMER ARRESTERS

A. Engineered water hammer arresters: ASSE 1010 listed, lead-free, pre-charged, permanently sealed, maintenance- free, suited for concealed installation, with a working temperature range of 33 to no less than 212 degrees F and a maximum working pressure of no less than 250 psi during pressure surges. Stainless steel or copper body construction. Shall be sized and located in accordance with Plumbing Drainage Institute standard PDI-WH 201.

B. ACCEPTABLE MANUFACTURERS:
1. J.R. Smith
2. Zurn
3. Mifab
4. Wade
5. P.P.P.

2.2 THERMOSTATIC MIXING VALVES

A. Provide thermostatic mixing valves in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings.

1. Unless scheduled otherwise, all units other than under-counter point of use units shall be provided complete in lockable cabinet of 16 gage (1.5 mm) prime coated steel when located in finished areas.
2. All under-counter point of use units shall be provided complete with integral checks and dual stainless steel strainers on inlets for protection against fouling.

B. Types and Requirements:
1. Where hot and cold water is supplied to emergency safety fixtures, the temperature shall be controlled by a temperature actuated mixing valve complying with ASSE 1071.
2. Valves for individual showers are addressed in Section 22 40 00 - Plumbing Fixtures
3. (Master) mixing valves serving multiple showers, each with a single tempered water supply pipe, shall conform to ASSE 1069 or CSA B125.3. Such valves shall be provided complete with unions, checks, and ball valves at all connections as well as a temperature gauge on the outgoing water line.
4. Mixing valves serving (athletic area) whirlpool applications shall conform to ASSE 1070 / ASME A112.1070 / CSA B125.70 or CSA B125.3. Such valves shall also be configured with appurtenances as described above.
5. Mixing valves supplying tempered water to lavatories and sinks shall conform to ASSE 1070 / ASME A112.1070 / CSA B125.70 or CSA B125.3.

C. ACCEPTABLE MANUFACTURERS:
1. Bradley
2. Powers
3. Symmons
4. Acorn
5. Leonard

2.3 DIGITAL MIXING VALVES

A. Provide digital mixing valves in accordance with manufacturer’s recommendations and as indicated and scheduled on Drawings

B. Valve assembly shall include, but not necessarily be limited to, the following features:
1. Pre-piped, wired, and tested complete from the manufacturer, on a rack suited for wall-mounted installation.
2. Electronic based temperature and pressure sensor elements continuously monitoring hot and cold water inlet supplies, mixed water outlet, and tempered water return.
3. Continuously modulating high-speed actuator located external to the associated three-way mixing valve where it is not subject to potential water leakage from the valve.
4. Certified to ASSE 1017 and capable of ± 2 degrees F temperature regulation.
5. Type L copper and lead-free valves, both full port stainless steel ball quarter turn and check type.
6. UL listed and lead-free listed to NSF 372.
7. Bronze-fitted, integrated hot water return circulating pump operated by the control module based on pre-set return temperature offset.
8. Smart controller interface with full-color, user selectable touch screen display complete with NEMA 3 enclosure and user programmable high temperature alarm and security pass code.
9. Built-in BAS compatibility.
10. Five (5) year manufacturer warranty.

C. ACCEPTABLE MANUFACTURERS:
1. Powers
2. Armstrong
3. Leonard

2.4 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains and floor sinks in accordance with manufacturer’s recommendations, as appropriate for floor construction per ASME A112.6.3, and as indicated and scheduled on Drawings.

B. Provide clamping devices for all drains in membrane floor areas.

C. ACCEPTABLE MANUFACTURERS:
1. J.R. Smith

2. Zurn
3. Mifab
4. Watts
5. Wade

D. Provide drains of suitable and compatible material for specialized piping systems conveying acid waste.

2.5 TRAP PRIMERS

A. General: Provide trap primers as indicated and scheduled on Drawings and in accordance with manufacturer's recommendations.

B. ACCEPTABLE MANUFACTURERS:
1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. P.P.P.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to provide intended performance.

B. Install equipment specific drains appropriately located to serve the equipment. Drain placement shall not conflict with housekeeping pads, casework, equipment access, clear space for foot travel, etc. In kitchens and similar settings final drain locations must be carefully coordinated to ensure that equipment casters, table legs, etc. do not bear upon drain grates.

C. Water hammer arresters:
1. The contractor shall provide water hammer arresters as shown on Drawings and also in accordance with PDI-WH 201, whether shown on Drawings or not.
2. Water hammer arresters shall be PDI certified and sized and placed as recommended by manufacturer.
3. Provide above lay-in ceiling, within chase or wall or above solid ceiling complete with access panel, or otherwise accessible location complete with isolation valve to facilitate replacement.
4. Provide for both domestic hot and cold water services.
5. The provision of air chambers for the control of water hammer shall not be acceptable, but for within dwelling units only, in residential occupancies only.

D. Backflow preventers:
1. Provide strainers at all backflow preventers.
2. Contractor shall certify all newly installed backflow preventers and provide proof of certification to the Owner.
3. Pipe relief line from backflow preventer via manufacturer's air gap assembly, full size to nearest suitable drain. Such routing shall not pose a trip hazard. Where a suitable drain of appropriate size is not provided, route line to the outdoors.
4. All backflow preventers shall be securely supported with wall supports and/or pipe stands as appropriate for the size and weight of the unit and shall be installed with sufficient access and clearance for testing and maintenance. Unless specifically noted otherwise on Drawings, all backflow preventers shall be installed at 48"-60" above finished floor.
5. Unless specifically noted otherwise on the Drawings, outdoor installations shall be housed within an appropriately sized, ASSE 1060 Class I freeze and vandal protective insulated, marine grade aluminum constructed enclosure complete with drain panel and removable/movable panel(s) for device maintenance and testing. Provide complete with manufacturer's recommended electric heater. Safe-T-Cover by Hydrocowl.

E. Cleanouts:
1. Provide two-way cleanouts at all waste outfalls from the building.
2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at all cleanouts for access and for rodding of drainage system.
3. Wall cleanouts provided at the end of horizontal piping runs shall be installed vertically above the flow line of the pipe served.
4. All cleanouts outside of building not in paved areas shall be set in an 18" x 18" x 4" thick concrete pad, flush with final grade.
5. All cleanouts shall be the same nominal size as the pipe they serve, up to 4 inches. For pipes larger than 4 inches, provide a 4 inch cleanout.

F. Interceptors:
1. Coordinate with casework to ensure that all interceptors are readily accessible and removable for servicing and cleaning.
2. Coordinate with casework to ensure that all point of use interceptors do not interfere with required accessibility requirements. Provide offset(s) as required and in accordance with code.
3. Provide approved sampling well downstream of centralized interceptors and separators and in all such locations where required by the local Authority Having Jurisdiction.
4. Installation shall be in accordance with the manufacturer's recommendations.
5. The following general installation requirements shall apply to concrete constructed interceptors, however these requirements are not intended to supercede the manufacturer's recommendations, which shall govern.
   a. The bottom of the excavation shall be covered with clean sand or pea gravel to a depth of no less than one foot, suitably graded and leveled. Limestone shall not be acceptable.
   b. If the installation location has significant variation in ground water levels, the bedding material shall be fine gravel or pea gravel rather than sand.
   c. The backfill shall be free from any material which may cause damage to the tank coating (if any) and placed accordingly.

G. Trap primers:
1. In unfinished areas such as mechanical rooms, such devices may be installed exposed.
2. In finished areas, all devices must be installed concealed from public view. If not readily accessible (such as above a lay-in ceiling) ensure to provide an access door.

3.2 PACKAGED AUTOMATIC SELF-CLEANING FILTRATION SYSTEM INSTALLATION

A. Arrange piping for easily dismantling to permit cleaning and service.

B. Install the system in accordance with the manufacturer’s installation, start-up and service instructions.

C. Provide system manufacturer start-up service; provide the services of factory trained service technicians to start up the system.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:
1. Domestic Water Heaters
2. Sump Pumps and Sewage Ejectors

1.3 RELATED SECTIONS

A. Section 11 40 00 - Foodservice Equipment

B. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

C. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

D. Section 22 10 00 - Plumbing Piping

E. Section 22 11 19 - Plumbing Specialties

F. Section 26 05 19 - Wire, Cable and Related Materials

1.4 REFERENCES

A. 10 CFR 430, Appendix E to Subpart B - Uniform Test Method for Measuring the Energy Consumption of Water Heaters; Current Edition.

B. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous; 2019.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 54 - National Fuel Gas Code; 2024.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

J. UL 1738 - Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Perform Work in accordance with Authorities Having Jurisdiction.

C. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

D. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
1. American Gas Association (AGA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
5. National Electrical Manufacturers' Association (NEMA).
6. Underwriters Laboratories (UL).
7. American Society of Plumbing Engineers (ASPE)

E. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Shop Drawings:
1. Include water heater and packaged heating system dimensions, sizes and locations of all connections, and performance data.
2. Include dimensions of tanks, tank lining and insulation methods, anchors, attachments, lifting points, sizes and locations of all connections and drains.
3. Include water softening equipment dimensions, sizes and locations of all connections, performance data and capacities, backwash requirements.
4. Include booster system skid dimensions, sizes and locations of all connections, and performance data. Include such information for any field connected items, including, but not necessarily limited to, hydro-pneumatic tanks.
5. Include manufacturer’s recommended space requirements, clearances, and maintenance access.

C. Product Data:
1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, materials of construction, capacity, power requirements, and any affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and power and controls connection requirements/capabilities.

D. Manufacturer's Installation Instructions.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment.

C. Provide written start-up reports.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 22.

B. Operation Data: Include manufacturer's operating instructions, common trouble conditions and remedies, and trouble-shooting protocols.

C. Maintenance Data: Include routine maintenance items and corresponding intervals, identify typical replacement parts including part numbers and availability. Provide location and full contact information including after-hours maintenance/support telephone numbers for manufacturer authorized maintenance and repair companies.

1.9 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled equipment to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of equipment to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept equipment on site in original factory packaging. Inspect for damage. Damaged equipment shall not be acceptable.

D. STORAGE: Store equipment in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two sets of electric water heater elements.

1.11 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 weeks prior to the proposed training session for review and approval.

B. 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.

1.12 REGULATORY REQUIREMENTS

A. Conform to AGA, NSF, NFPA 54, NFPA 70 and UL 1453 requirements for water heaters.

B. Conform to ASME BPVC-VIII-1 for manufacture of pressure vessels for heat exchangers.

C. Conform to water heater minimum efficiency requirements prescribed by ICC (IECC) and ASHRAE Std 90.1 I-P

D. Water heaters shall be tested and rated in compliance with 10 CFR 430, Appendix E to Subpart B or ANSI Z21.10.3 as applicable.

1.13 WARRANTY

A. Provide one year warranty under provisions of Division One, unless specifically noted otherwise.

B. Warranty: Include coverage of domestic water heaters and packaged systems, water storage tanks, water softeners, and domestic pressure booster systems.

PART 2 - PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS (STORAGE TYPE)

A. Acceptable Manufacturers:
1. A.O. Smith
2. State
3. Rheem
4. Lochinvar
5. Bradford White
6. Bock

B. Type: Factory-assembled and wired, electric, vertical storage.

C. Tank: Glass lined welded steel; 4 inch diameter inspection port (when applicable), thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic water thermostat with externally adjustable temperature range from 110 to 170 degrees F (approximate, based on element configuration), replaceable elements of zinc plated copper or nickel chromium alloy, high temperature limit cutoff, enclosed controls and electrical junction box.

E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

F. Provide training per 1.11.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Acceptable Manufacturers:
1. Watts
2. Amtrol
3. Elbi
4. Bell and Gossett

B. Rating: Ensure suitable pressure rating of tank for expected system pressure.

C. Construction: Welded steel construction, corrosion-proof anti-microbial polypropylene liner, long-life butyl diaphragm, stainless steel system connection, factory pre-charged, complete with welded air charge fitting with protective cap. Suitable for in-line installation or factory provided with stand/legs for floor-mounted installation.

2.3 IN-LINE CIRCULATOR PUMPS

A. Acceptable Manufacturers:
1. Grundfos
2. Bell & Gossett
3. Armstrong

B. Type: Canned rotor type.

C. Housing: Bronze or stainless steel, rated for 125 psig working pressure.

D. Impeller: 304 stainless steel.

E. Shaft: Stainless steel or aluminum oxide ceramic.

F. Thermal Protection: Internal.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, NFPA 54 and UL requirements.

B. Coordinate with plumbing piping and related work to achieve operating system.

C. Provide intake air/venting and associated piping in accordance with both code requirements and manufacturer's recommendations. The material and installation provided must not only be compatible with the equipment served but must also be suited to and acceptable per project conditions. Any material to be provided in a return air plenum must be compliant for such use. Any plastic piping must be UL 1738 certified and where located outdoors shall be painted with latex paint for UV protection.

D. Provide a properly sized thermal expansion tank downstream of the associated check valve in the cold water supply to the heater.

E. Provide a thermometer at the hot water outlet piping from each water heater.

F. Provide a line sized shut-off valve in the cold water supply to and in the hot water outlet from each heater, close to each heater.

G. Provide approved heat traps at all storage type water heaters not furnished from the manufacturer with integral heat traps or heat trap nipples.

H. Provide a line size plug cock in the gas supply close to each gas-fired water heater.

I. Provide approved dielectric couplings at all hot and cold water connections to each heater/tank, and at the T&P relief valve connection.

J. All tank type water heaters with more than 20 gallons of storage capacity shall be floor mounted on a concrete housekeeping pad, unless specifically indicated otherwise on the Drawings.

K. Each tank type water heater shall be installed within a suitably sized galvanized drain pan. Securely elevate the base of each heater above the floor of the drain pan with structurally sound, non-ferrous, non-absorbent supports. Drain pan shall have no less than a 3/4" piped drain outlet.

L. All water heater drain lines shall be full size, copper, and routed to indirect waste receptors.

M. Startup:
1. Startup of all water heaters shall be in strict accordance with manufacturer's recommendations.
2. Ensure that storage type water heaters are full of water and downstream fixtures have been run for no less than 3 minutes in order to purge any trapped air from the water heater tank prior to heater startup.

3.2 CARBON MONOXIDE AND FUEL GAS DETECTION

A. In each boiler room, and in each water heater room with more than 200,000 BTUH total heating capacity or more than 120 gallons of total storage, provide detectors for carbon monoxide and natural gas (or propane, as appropriate), complete with manual reset.

B. Each detector shall be configured/interlocked to:
1. Disable the equipment burners upon loss of power to the detector.
2. Disable the equipment burners when the measured level of carbon monoxide rises above 50 ppm or 10% LEL (lower explosive limit) of the fuel gas

3.3 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide air cock and drain connection on horizontal pump casings.

C. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

D. Provide line sized isolating valve and line sized soft seated check valve on each submersible or sump pump discharge. Ensure to drill a 3/16" diameter horizontal weep hole near the base of the discharge piping to allow for venting and prevent air lock of the pump.

E. Provide line sized isolating valve and strainer at inlet and line sized soft seated check valve and line sized isolating valve at outlet of each in line circulator pump. Provide unions on both sides of pump.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

G. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

H. Align and verify alignment of base mounted pumps prior to start-up. Provide alignment certificate to engineer prior to start-up.

3.4 WATER SOFTENER INSTALLATION

A. Arrange piping for easy dismantling to permit cleaning and service.

B. Install the system in accordance with the manufacturer's installation, start-up and service instructions.

C. Provide a complete set of instructions covering the installation, operation and servicing of the water softener.

D. Provide system manufacturer start-up service.
1. Provide the services of factory trained service technicians to start up the system. Technicians shall be trained and experienced on the work they conduct. Technician shall possess a current Class III WTS License from TCEQ.
2. Provide and fill the brine tank with enough food grade pellet salt for ten (10) regenerations at maximum brining.

3. Monitor the operation of the softener and set the time clock for an average period between cycles so that regeneration occurs in the early morning hours during a period of zero usage
4. Follow the manufacturer's start up procedures.
   a. Verify interlocks.
   b. Test and verify operation of controls.
   c. Calibrate controls.

3.5 DOMESTIC HOT WATER STORAGE TANK INSTALLATION

A. Install tanks in accordance with manufacturer's instructions.

B. Provide steel pipe support for tanks, independent of building structural framing members.

C. Clean and flush tank after installation. Seal until pipe connections are made.

END OF SECTION

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SECTION 23 02 00

BASIC MATERIALS AND METHODS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect/Engineer for review as soon as practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is the equivalent of that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Mechanical (HVAC) items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the commissioning process as required; including, but not limited to, meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The Contract Documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed shop drawings.

B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) systems.

C. Furnishing and installing all required Mechanical (HVAC) equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF SUBSTANTIAL COMPLETION

A. The date of final acceptance shall be the date of substantial completion. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct - properly protected from incidental damage and weather damage.

C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe or duct shall be installed in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 DELEGATED DESIGN FOR ANCHORAGE OF ROOF MOUNTED EQUIPMENT

A. The Contractor shall engage a qualified professional engineer to design all roof mounted equipment curbs, equipment supports, equipment tie downs, equipment connections, and methods of attachment for components that are to be anchored to the building structure. The design shall comply with wind load and uplift requirements utilizing design criteria per ICC (IBC) and ASCE 7 unless criteria is otherwise indicated in the Construction Documents.

B. Submittal: Signed and sealed engineering analysis data and accompanying details, drawings, and supplemental installation information shall be submitted to the engineer for review.

1.11 APPLICABLE CODES AND STANDARDS

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements which includes and is not limited to the following nationally accepted codes and standards:
   1. Air Moving & Conditioning Association, AMCA.
   2. American Standards Association, ASA.
   3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
   4. American Society of Mechanical Engineers, ASME.
   5. American Society of Plumbing Engineers, ASPE.
   6. American Society of Testing Materials, ASTM.
   7. American Water Works Association, AWWA.
   8. National Bureau of Standards, NBS.
   9. National Fire Protection Association, NFPA.
   10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
   11. Underwriters' Laboratories, Inc., UL.
   12. International Building Code, IBC.
   13. International Energy Conservation Code, IECC.
   14. International Fire Code, IFC.
   15. International Fuel Gas Code, IFGC.
   16. International Mechanical Code, IMC.

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.12 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor, or its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or, when so noted, by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.13 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the Work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is the equivalent of the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturer's standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equivalent capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 calendar days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equivalent construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUIVALENT" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUIVALENT" product, material or method may be used if it complies with the Specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with the requirements listed above; and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with their respective trade(s) and all other trades; and to pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.14 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty-day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
   1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
   2. An index page with a listing of all data included in the Submittal.
   3. A list of variations page with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
   4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
   5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
   6. Identification of each item of material or equipment matching that indicated on the Drawings.
   7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
   8. Additional information as required in other Sections of this Division.
   9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
   1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating that the submittal meets all conditions of the Contract Documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified. The Contractor will automatically be required to furnish the product, material or method named in the Specifications. Contractor shall not order equipment when submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without submittal review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not limited to, the following items subject to project requirements:
1. Coordination Drawings
2. Common Motor Requirements for HVAC Equipment
3. Expansion Fittings and Loops for HVAC Piping
4. Variable Frequency Motor Speed Control for HVAC Equipment
5. Hangers and Support for Piping and Equipment HVAC
6. Vibration and Seismic Controls for HVAC Piping and Equipment
7. Testing, Adjusting, and Balancing
8. Duct Insulation
9. HVAC Equipment Insulation
10. HVAC Piping Insulation
11. Refrigerant Monitor System
12. Energy Management and Control System
13. Above Ground Hydronic Piping
14. Hydronic Specialties
15. Hydronic Pumps
16. Refrigerant Piping
17. Metal Ductwork
18. Ductwork Accessories
19. Duct Silencers
20. HVAC Fans
21. High-Volume Low-Speed Propeller Fans
22. Dust Collection Systems
23. Series Fan Powered Terminal Units
24. Single Duct VAV Terminal Box
25. Parallel Fan Powered Terminal Unit
26. Dual Duct Air Terminal Units

27. Air Distribution Devices
28. HVAC Gravity Ventilators
29. Air Filters
30. Air Purification Systems
31. Flue Pipe Systems
32. Non-Condensing Boilers
33. Condensing Boilers
34. Finned Water-Tube Boilers
35. Steel Water-Tube Boilers
36. Gas Fired Furnaces
37. Gas Fired Roof Mounted Make-up Air Unit Heaters
38. Shell and Tube Heat Exchanger
39. Plate-Type, Liquid-To-Liquid Heat Exchangers
40. Centrifugal Liquid Chiller
41. Rotary Screw Water Chillers
42. Air Cooled Rotary Liquid Chiller
43. Induced Draft Cooling Tower
44. Energy Recovery Ventilator
45. Modular Indoor Central Station Air Handling Units
46. Packaged Air Handling Unit
47. Modular Outdoor Central Station Air Handling Units
48. 100% Outside Air Rooftop Unit with Gas Heat
49. Self-Contained Air Conditioners
50. Rooftop Heating and Cooling Units Electric Cooling-Gas Heating
51. Rooftop Heating and Cooling Units Electric Cooling-Electric Heat
52. Variable Air Volume Rooftop Units
53. Split System Air-Conditioners - Wall-Mounted
54. Variable Refrigerant Flow (VRF) for HVAC System
55. Water Source Heat Pump Unit
56. Fan Coil Unit
57. Unit Ventilators
58. Electric Unit Heaters
59. Electric Duct Heaters
60. Radiant Heating Electric Cables
61. Air Conditioning Unit for Swimming Pool Enclosures

I. Refer to other Division 23 sections for additional submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.15 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
      a. Wall and type locations.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm and sanitary sewer piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting coordination drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.16 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 23.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:
1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.17 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with Division 00 and Division 01 and, in addition to the requirements specified in those Divisions, include the following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
      a. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
      b. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
      c. Servicing instructions and lubrication charts and schedules.

1.18 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled date for each test. This detailed completion and test schedule shall be submitted at least 90 days before the projected substantial completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of substantial completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to, those items outlined in Section 23 02 00.

1.19 OPERATING AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 23. In addition to the requirements of other Sections, this shall include the following information for equipment items:
   1. Identifying names, name tags designations and locations for all equipment.
   2. Valve tag lists with valve number, type, color coding, location and function.
   3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
   4. Fabrication drawings.

5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.
12. Color coding charts for all painted equipment and conduit.
13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow ¼” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.20 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of onsite training in three (3) shifts of four (4) hours each.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 23 Sections for additional Operator Training requirements.

1.21 FINAL COMPLETION

A. At the completion of the Work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.

B. Clean and adjust all air distribution devices and replace all air filters immediately prior to Substantial Completion.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to Substantial Completion.

1.22 CONTRACTOR'S GUARANTEE

A. Use of the HVAC systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing; and, if granted, shall not cause the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after the date of the Substantial Completion, and shall furnish (free of additional cost to the Owner) all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air conditioning compressors shall have parts and labor guarantees provided by the equipment manufacturer for a period of not less than 5 years beyond the date of Substantial Completion.

E. Refer to Sections in Division 23 for additional guarantee or warranty requirements.

1.23 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently, or otherwise, without authorization of the data’s creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be at the Contractor’s sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect’s written consent.
   1. It is agreed that “MEP” hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for “record purposes”, then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD’s. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner’s request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a “.rvt” or “.dwg” format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with “Buy American Act.”

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C. All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D. Access Doors: shall be as follows:
1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install doors only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide 6-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B. Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Divisions 2 through 48 for additional rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as possible, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access doors where units are concealed behind finished surfaces. Refer to paragraph 2.1 in this section and architect for access doors specifications and location.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curbs which match the roof slope and provides a level top for equipment installation. Refer to Architectural drawings and details.
14. The equipment to be furnished under these Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The Architectural and Structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.
19. Provide construction filters for all air handling units, fan coil unit, VAV boxes, and all other air handling equipment during the entire construction period.
20. Provide temporary construction strains for all strainers in the hydronic systems during the initial flushing of the systems.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective Work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
   7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Paragraph 1.11 I for definition of "Installer."

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
   1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
   2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
   3. Contractor shall not start-up any of the HVAC equipment unless the Owner, Architect and Engineer are signed off.
   4. Start-up for major HVAC equipment such as chillers, cooling towers, variable frequency drives and hot water boilers shall be performed by a factory technician. The start-up shall include a written report signed off by Contractor, Engineer and Owner.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to, the existing piping, duct, equipment and other apparatus related to this phase of the Work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, duct, etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing areas with a minimum of interruption.

J. All existing pipe, duct, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical and other Owner's equipment, etc., which is to remain but is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

END OF SECTION

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SECTION 23 03 00

MECHANICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

B. The Drawings do not show all demolition work required. The Contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.

C. Utility service outages required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.2 RELATED SECTIONS

A. Section 02 40 00 - Demolition and Structure Moving.

1.3 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

A. The Owner will cooperate with the Contractor; however, the following provisions must be observed:
1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and Sub-subcontractors, and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

1.4 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, duct, equipment and other apparatus related to this phase of the Work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage which occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, duct, etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing areas with a minimum of interruption.

J. All existing pipe, duct, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical and other Owner's equipment, etc., which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify measurements, and piping arrangements are as shown on Drawings.

B. Verify that abandoned piping and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing Record Documents. Report discrepancies to Architect and Engineer before disturbing existing installation.

D. Beginning of demolition means that the contractor accepts existing conditions.

3.2 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary connections, if required, to maintain existing systems in service during construction. When work must be performed on energized equipment, use personnel experienced in such operations.

D. Existing Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of Division 02 and this Section.

B. Remove, relocate, and extend existing systems to accommodate new construction.

C. Remove abandoned piping to source of supply.

D. Remove exposed abandoned piping systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing systems which remain active. Modify installation or provide access doors as appropriate.

G. Extend existing systems using materials and methods compatible with existing systems, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 02.

3.6 REMOVAL OF MATERIALS

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operating condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

E. Certain work during the demolition and construction phases may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner's Representative at least 72 hours in advance in writing.

F. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch, or replace as required any damage which occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction. Cooperate with the Owner and other trades in scheduling and performance of the work.

G. See Paragraph I on page 23 02 00 – 18

H. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

I. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

J. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

END OF SECTION

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SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. WORK SPECIFIED ELSEWHERE:
1. Painting
2. Automatic temperature controls
3. Power control wiring to motors and equipment

1.3 WARRANTY

A. Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion.

1.4 REFERENCE STANDARDS

A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

B. NEMA MG 1 - Motors and Generators; 2021.

1.5 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.6 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.
1. Baldor
2. Marathon
3. Siemens-Allis
4. General Electric
5. U.S. Motor

B. TEMPERATURE RATING: Provide insulation as follows:
1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.
1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
3. Name plate voltage shall be the same as the circuit's nominal voltage, serving the motor.

E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F. FRAMES: U-frames 1.5 hp. and larger.

G. BEARINGS: Provide sealed re-greaseable ball bearings; with top mounted Zerk lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:
1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional hp. motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures as follows, except where otherwise indicated:
1. CONCEALED INDOOR: ODP (Open Drip Proof).
2. EXPOSED INDOOR: Guard Protected.
3. OUTDOOR TYPICAL: Type II. TEFC.
4. OUTDOOR WEATHER PROTECTED: Type I. WPI.
5. EXPLOSION PROOF, XP: For use in hazardous locations.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. All motors that are to be operated by a variable frequency drive shall be inverter duty rated motors.

L. All motors operated by variable frequency drive shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.

M. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE 112, Method B, including stray load loss measure.

NEMA MG 1 Efficiency - 1800 RPM Synchronous Speed		
Motor horsepower	Index Letter	Minimum Efficiency

3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	95.0
60	C	95.0
75	C	95.0
100 - 125	B	95.4
150 - 200	B	95.8

NEMA MG 1 Efficiency - 1200 RPM Synchronous Speed		
Motor horsepower	Index Letter	Minimum Efficiency
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.2 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 23) shall be furnished under Division 23 and installed under Division 26 unless otherwise noted on the plans.
   1. Starters shall be provided for 3 phase motors 1 horsepower and greater.

B. Motor starters shall be furnished as follows.
   1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
   2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
   3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
   4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
   5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
   6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
   7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
   8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
   9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
   10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers.

11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.
1. Siemens.
2. Square D.
3. General Electric.
4. Eaton.

2.3 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.02-B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 26 28 16.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.
1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

C. Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

D. Install rotating equipment in static and dynamic balance.

E. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

F. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

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SECTION 23 05 16

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Flexible pipe connections.

B. Expansion joints and compensators

C. Pipe loops, offsets, and swing joints.

1.3 RELATED WORK

A. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B. Section 23 21 13 - Above Ground Hydronic Piping

C. Section 23 22 13 - Steam and Condensate Heating Piping

D. Section 23 23 00 - Refrigerant Piping

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:
1. Installation Temperature: 50 degrees F (10 degrees C)
2. Hot Water Heating: 210 degrees F (99 degrees C)
3. Domestic Hot Water: 140 degrees F (60 degrees C)
4. Steam: 380 degrees F (193 degrees C)
5. Steam Condensate: 212 degrees F (100 degrees C)
6. Safety Factor: 30 percent.

C. Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer's literature for model series for different pipe sizes.

1.5 SUBMITTALS

A. Submit shop drawings under provisions of Division One.

B. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot (meter) and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Design Data: Indicate selection calculations.

D. Manufacturer`s Installation Instructions: Indicate special procedures, and external controls.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of flexible pipe connectors, expansion joints, anchors, and guides.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include adjustment instructions.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Division One.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.10 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.1 FLEXIBLE PIPE CONNECTORS

A. Steel Piping (Based on 2" Pipe):
   1. Manufacturers:
      a. VMC Group, Model SS-PM or SS-FP
      b. Mercer Rubber Company, Model BSS-EM (Mason Industries)
   2. Inner Hose: Type 321, stainless steel, corrugated metal.
   3. Exterior Sleeve: Type 304, single braided stainless steel.
   4. Pressure Rating: 350 psig WOG and 70 degrees F. For 4 inch pipe - 200 psig WOG and 70 degrees F.

5. Joint: Schedule 40 steel, threaded with male nipple and hex boss each end and union. Flanged joints for pipe sizes 2½ inch and larger.
6. Size: Use pipe sized units.
7. Maximum offset: 1/2 inch on each side of installed center line.
8. Application: Air handling unit cooling and heating coils.

B. Copper Piping (Based on 2" Pipe):
1. Manufacturers:
   a. VMC Group, Model BR-FS
   b. Mercer Rubber Company, Model BFF (Mason Industries)
2. Inner Hose: Corrugated Bronze
3. Exterior Sleeve: Braided bronze.
4. Pressure Rating: 250 psig WOG and 70 degrees F.
5. Joint: Threaded with male nipple and hex boss each end with union. Flanged joints for pipe sizes 2½ inch and larger.
6. Size: Use pipe sized units.
7. Maximum offset: 1/2 inch on each side of installed center line.
8. Application: Air handling unit cooling and heating coils.

2.2 EXPANSION JOINTS

A. Bellows Type (Based on 4" Pipe):
1. Manufacturers:
   a. VMC Group, Model EB
   b. Mercer Rubber Company, Model 803 or 805 (Mason Industries)
2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

2.3 ACCESSORIES

A. Pipe Alignment Guides to Direct Axial Movement:
1. Manufacturers:
   a. Metraflex, Style IV
2. Two piece welded steel with shop paint, and bolted to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer`s instructions.

B. Construct spool pieces to exact size of flexible connection for future insertion.

C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provided line size flexible connectors.

D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

E. Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

3.2 MANUFACTURER`S FIELD SERVICES

A. Prepare and start systems under provisions of Division One.

B. Provide inspection services by flexible pipe manufacturer`s representative for final installing and certify installation is in accordance with manufacturer`s recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 23 05 26

VARIABLE FREQUENCY MOTOR SPEED CONTROL FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Section 1.01 A in Section 23 05 13

B. Section 1.01 B in Section 23 05 13

C. Furnish and install a complete adjustable frequency motor speed control for the following items:
1. Variable volume air handling units.
2. Variable volume ventilation fans.

1.2 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 09 63 - Energy Management and Control System (EMCS)

F. Section 23 21 23 - Hydronic Pumps

G. Section 23 73 13 - Modular Indoor Central Station Air Handling Units (Falcon Pass)

1.3 REFERENCES

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

E. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Certified noise data shall be submitted by drive manufacturer. Noise generated by variable frequency motor speed control drive shall not exceed preferred “RC” as listed in 2019 ASHRAE (HVACA), Chapter 49 Noise and Vibration Control, Table 2 Criteria for Acceptable HVAC Noise in Unoccupied Rooms.

1.5 WARRANTY

A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll-free phone number.

1.6 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be stored and handled per manufacturer's instructions.

1.7 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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ABB

B. Yaskawa/Magnetek

2.2 ADJUSTABLE FREQUENCY INVERTER

A. The AFD package as specified herein shall be enclosed in a NEMA 12 enclosure for interior applications, a NEMA 3R enclosure for exterior locations and a NEMA 4X enclosure where located in a cooling tower yard or within 20 feet from cooling tower. All enclosures shall be completely assembled and tested by the manufacturer in an ISO 9001 facility. The AFD shall operate from a line of +30% over nominal and the under-voltage trip level shall be 35% under the nominal voltage as a minimum.

B. The fused input shall utilize fast acting current limiting type per manufacturer recommendations.

C. The variable frequency power and logic unit shall be completely solid state. The unit shall transform 480 Volt or 208 Volt (as indicated on plans), 3 phase, 60 hertz input power into frequency and voltage controlled, 3 phase output power suitable to provide positive speed and torque control to the fan motor. The speed control shall be step-less throughout the speed range under variable torque load on a continuous basis. The adjustable frequency control shall be of a pulse width modulated type utilizing a full wave diode bridge rectifier; and shall have a power factor of 0.95 or better at all motor loads.

D. All AFD's shall have the same customer interface, including a backlit LCD two-line digital display, and keypad, regardless of horsepower rating. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus. The keypad shall be removable, capable of remote mounting, and shall have its own non-volatile memory. The keypad shall allow for uploading and downloading of parameter settings as an aid for the start-up of multiple AFD's. The keypad shall include Hand-Off-Auto membrane selections. When in "Hand", the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. When in "Auto", the AFD will start via an external contact closure and the AFD speed will be controlled via an external speed reference.

E. The adjustable frequency inverter shall conduct no radio frequency interference (RFI) back to the input power line.

F. The AFD shall have an integral 5% impedance line reactor to reduce the harmonics to the power line and to add protection from AC line transients. The inverter/reactor shall be a single wiring point.

2.3 SELF PROTECTION

A. The following features for self-protection shall be included:
1. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes. The minimum FLA rating shall meet or exceed the values in the NFPA 70 - Table 430-150 for 4-pole motors.
2. Limit the output current in under 50 microseconds due to phase to phase short circuits or severe overload conditions.
3. Protect the inverter due to non-momentary power or phase loss. The undervoltage trip shall activate automatically when the line voltage drops 15% below rated input voltage.
4. Protect the inverter due to voltage levels in excess of its rating. The overvoltage trip shall activate automatically when the DC bus in the controller exceeds 1000 VDC.
5. Protect the inverter from elevated temperatures in excess of its rating. An indicating light that begins flashing within 10 degrees C of the trip shall be provided to alert the operator to the increasing temperature condition. When the over temperature trip point is reached, this light shall be continuously illuminated.
6. The inverter shall be equipped such that a trip condition resulting from overcurrent, undervoltage, overvoltage or overtemperature shall be automatically reset, and the inverter shall be automatically reset, and the inverter shall automatically restart upon removal, or correction of the faulty condition.
7. Status lights for indication of conditions described above shall be provided. A SPDT contact for remote indication shall be provided. Additionally, status lights to show power on, zero speed, and drive enabled shall be provided. All status lights shall be self-contained in the front panel of the unit and shall be duplicated for ease of troubleshooting on the inside of the unit.
8. Current and voltage signals shall be isolated from logic circuitry.
9. Drive logic shall be microprocessor based.
10. In the event of a sustained power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation if the start is in the “On” condition.
11. In the event of a momentary power loss, the control shall be shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation (if the start is in the “On” position) being able to restart into a rotating motor regaining positive speed control without shutdown or component failure.
12. In the event of a phase to phase short circuit, the control shall shut down safely without component failure.
13. In the event that an input power contactor is opened or closed while the control is activated, no damage shall result.
14. To facilitate startup and troubleshooting, the control shall operate without a motor or any other equipment connected to the inverter output.

2.4 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual full bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the “bypass” mode. Fast-acting semi-conductor with a fuse block shall be provided to isolate the drive for service. Bypass designs that have no such fuses must have a lockable disconnect that isolates the drive while running in bypass mode. The contactor device shall be NEC approved. A common start/stop signal shall be used for both the variable frequency drive mode and bypass mode. Manual bypass shall contain the following:
1. Two contactors mechanically interlocked via a three position through the door selector switch or keypad to provide the following controls:
a. “Inverter” mode connects the motor to the output of the inverter.

b. “Bypass” mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via electronic overload.
c. “Off” mode disconnects motor from all input power.
d. A molded case circuit breaker with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
e. Customer Interlock Terminal Strip - provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is Hand, Auto, or Bypass mode. The remote start/stop contact shall operate in AFD and bypass modes.
f. An electronic overload selectable for class 20 or 30 shall provide protection of the motor in Bypass mode.

2. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.
   a. Power on
   b. External fault
   c. Drive mode selected
   d. Bypass mode selected
   e. Drive running
   f. Bypass running
   g. Drive fault
   h. Bypass fault
   i. Bypass-H-O-A mode
   j. Automatic transfer to bypass selected
3. The following relay (form C) outputs from the bypass shall be provided:
   a. System started
   b. System running
   c. Bypass override enabled
   d. Drive fault
   e. Bypass fault (motor overload or underload (broken belt))
   f. Bypass H-O-A position
4. The AFD shall include a “run permissive circuit” that will provide a normally open contact any time a run command is provided (local or remote start command in AFD or bypass mode). The AFD system (AFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch). When the AFD systems safety interlock (fire detector, freezestat, high static pressure switch, etc.) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.
5. There shall be an internal switch to select manual or automatic bypass.
6. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication when in the bypass mode.
7. The bypass mode must include an undervoltage and phase loss relay to protect the motor from single phase power and undervoltage conditions.
   a. Bypass shall be UL listed.
   b. Bypass shall carry a UL 508 label.

2.5 FEATURES AND SPECIFICATIONS

A. Provide all drives and bypasses with an integral disconnect switch. The disconnect shall be door interlocked and lockable. All disconnect configurations shall be UL Listed by the drive manufacturer as a complete assembly and include a UL 508A label.

B. Output frequency shall neither vary with load nor with any input frequency variations. Output frequency shall not vary within +/-10% input voltage changes. Output frequency shall not vary with temperature changes within the ambient specification.

C. No auxiliary equipment shall be required. The output frequency shall be adjusted in proportion to 4-20 mA signal.

D. A 0 to 10 Volt DC signal shall be provided for remote indication. This 0 to 10 Volt DC signal shall vary in direct proportion to the controller speed.

E. The controller shall be started or stopped by a contact closure or through serial communications.

F. A single pole, double throw contact shall be provided for remote indication. Contact will change state when any trip condition has occurred. (contact rated for 12-250 VAC-2 AMPS).

G. A second single pole, double throw contact shall be provided for remote indication. Contact will state when the VFD receives a run command (contact rated for 12-250 VAC-24 AMPS).

H. PID Setpoint controller shall be standard in the drive, allowing a pressure or flow signal to be connected to the AFD, using the microprocessor in the AFD for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus.

I. Unit to operate from a 4 to 20 mA input signal and shall have hand-off-auto switch and door mounted potentiometer controls for manual speed selection.

J. Acceleration and deceleration times shall be adjustable from 30 to 300 seconds.

K. The drive shall have the ability to invert the speed signal input, as well as having offset and gain controls for speed signal conditioning.

L. Minimum and maximum speeds shall be adjustable in automatic and manual modes.

M. Hazard inputs shall be provided, capable of up to two inputs (fire, freeze). These shall each be capable of safely shutting down the inverter and illuminating a front panel hazard light depicting that a hazard condition turned the inverter off.

N. The inverter shall be a starter, containing a door interlocked input disconnect switch and manual reset motor electronic overloads, with accessible reset on front door, when a bypass is not specified.

O. Solid state ground fault interrupt circuit.

P. The LED display shall monitor and display four parameters on a single display (i.e. frequency command, output frequency, output current, and torque).

Q. A N.O. auxiliary run-time contact shall be provided for control signaling to auxiliary equipment. Contact shall close when the pump is brought on line and open when the pump is taken off line. Contact shall be rated 20 amps at 120 volts.

R. Inverter shall be UL listed.

S. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the Owner, and a copy kept on file at the manufacturer

T. Factory trained application engineering and service personnel that are thoroughly familiar with the AFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

U. A computer based training CD or 8-hour professionally generated video shall be provided to the Owner at the time of Substantial Completion. The training shall include installation, programming and operation of the AFD, bypass and serial communication.

V. Provide a motor end surge control voltage suppressive filter if the VFD manufacturer cannot limit their voltage surges to under 1000 volt at 100 feet.

W. Provide a motor acoustic noise reduction filter capable of approximately 12 dBA attenuation, if the VFD raises the dBa level above 3 dBa at a distance of 3 feet from the motor.

X. Provide each unit with a 3% reactor which is mounted on both the positive and negative DC bus. The reactor shall be a single wiring point and mounted internally to the drive.

Y. Adjustable frequency inverters shall have native BACnet protocol for integration with EMCS. If the inverter does not have native BACnet protocol, a BACnet interface card shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install drives in accordance with manufacturer's published installation instructions. Installation location shall provide all required clearances around each drive.

B. All wiring shall be installed in accordance with the manufacturer's installation instructions.

C. Variable frequency speed drives shall be located so that wiring to the associated motor does not exceed 100 feet.

D. Separate metal conduits shall be provided for each of the following. None of these wiring categories shall be run within the same conduit.
1. Line side, input power wiring
2. Load side, motor power wiring
3. Control or communication wiring
4. Fire alarm system wiring

3.2 START-UP

A. Start-up services shall be provided for each unit by a factory authorized service provider.
1. Complete installation inspection and start-up checks according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.3 RELATED WORK

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

B. Section 23 07 16 - HVAC Equipment Insulation

C. Section 23 07 19 - HVAC Piping Insulation

D. Section 23 21 13 - Above Ground Hydronic Piping

E. Section 23 21 16 - Underground Hydronic Piping

1.4 REFERENCES

A. ASME B31.1 - Power Piping; 2024.

B. ASME B31.9 - Building Services Piping; 2020.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.5 QUALITY ASSURANCE

A. Hangers and Supports for HVAC Piping: In conformance with ASME B31.1 and ASME B31.9.

B. Hangers and Supports for HVAC Piping: In conformance with MSS SP-58.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

C. Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipes Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipes Sizes 2 to 4 Inch: Carbon steel, adjustable clevis.

C. Hangers for Pipes Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roller, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers, pre-formed manufactured saddles and hanger rods; cast iron roller and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roller.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roller and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.
   1. For pipes 2-1/2” and smaller - Type PP10 with roller
   2. For pipes 3” through 8” - Type PS
   3. For multiple pipes - Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L. Shields for Vertical Copper Pipe Risers: Sheet lead.

M. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief “Pipe Titan” or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/Architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

B. For metal roof construction, roof curbs shall be made of aluminum or stainless steel. Coordinate with Architectural Drawings and details.

2.6 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes through Beams, Interior Walls, Exterior Walls, Footings, and Potentially Wet Floors: Form with steel pipe, Schedule 40, galvanized.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed, manufactured by Hilti.

D. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

E. Caulk: Paintable 25-year acrylic sealant.

F. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.7 MECHANICAL SLEEVE SEALS

A. Modular sealing element unit, designed for field assembly, to continuously fill annular space between pipe and sleeve and create watertight seal.
   1. Approved Manufacturers:
      a. Link-Seal by Garlock Pipeline Technologies (GPT)
      b. Innerlynx by Advance Products & Systems, Inc.
      c. MetraSeal by Metraflex Co.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material, size of pipe, and service requirements.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.9 FINISH

A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with Structural Engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with Structural Engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow, and at the vertical to horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor.

G. For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners, hardware, braces, unistrut, structural steel members, and appurtenances required to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

K. Portable pipe hanger systems shall be installed per manufacturer's instructions.

L. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.3 INSULATED PIPING

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.

C. Shields: Install protective shields MSS SP-58 Type 40 on cold and chilled water piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.

D. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

Nominal Pipe Size	Shield Length	GaugeThickness
1/4 through 3-1/2 inch	12	18
4 inch	12	16
5 through 6 inch	18	16
8 through 14 inch	24	14
16 through 24 inch	24	12

E. Piping 2" and larger: provide galvanized sheet metal shields with calcium silicate insulation at hangers/supports.

F. Insert material shall be at least as long as the protective shield.

G. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

D. Construct support of steel members. Brace and fasten with flanges bolted to structure.

E. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for mechanical roof installations that extend minimum 8 inches above adjacent roofing surface. Contact Architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Sleeves shall be provided at the following locations:
1. Piping passing through rated and non-rated floor assemblies, rated ceiling assemblies, and roof assemblies.
2. Piping passing through concrete, masonry, and rated gypsum board walls and partitions.
3. Piping passing through exterior wall assemblies above and below grade.
4. Piping passing through non-rated gypsum board walls and partitions where indicated on the drawings or where exposed to view.
5. Piping passing through structural members where indicated on the drawings or where exposed to view.
6. Any other locations indicated on the drawings.

B. Set sleeves in position in formwork. Provide reinforcing around sleeves.

C. Extend sleeves through floors minimum one inch above finished floor level. Sleeves located in walls, ceilings, and structural members shall be flush with the outer surfaces of the assembly being penetrated.

D. Where sleeved piping penetrates a floor, ceiling, or interior wall assembly, pack annular space between pipe and sleeve with UL listed fire stopping insulation and caulk seal airtight with fire barrier sealant. Provide close fitting metal collar or escutcheon covers at both sides of wall penetrations and exposed side of ceiling penetrations.

E. Install all UL listed, prefabricated fire rated steel sleeves per the manufacturer’s installation instructions to ensure fire rating is maintained.

F. Sleeves at exterior walls below grade shall be sealed with mechanical sleeve seal. Install seal per manufacturer’s installation instructions. Select type and number of sealing elements required for pipe material, pipe size, and service requirements. Position pipe in center of sleeve. Assemble mechanical sleeve seal and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal. Locations above grade shall be provided with close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Vibration and sound control products.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

C. Unless otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. VMC Group

B. Mason Industries, Inc.

C. Kinetics Noise Control, Inc.

D. Vibration Eliminator Co., Inc.

2.2 GENERAL

A. Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B. Model numbers of VMC Group products are included for identification. Products of the listed manufacturers will be acceptable provided they comply with all the requirements of this specification.

2.3 FLOOR MOUNTED AIR HANDLING UNITS AND ENERGY RECOVERY UNITS

A. Provide VMC Group model CAL-2 aluminum housed isolators sized for 2” static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication.

B. If floor mounted air handling units are furnished with internal vibration isolation option, provide VMC Group model SP-NRC, style E, consisting of two layers of 1" thick ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate to address high frequency breakout and afford additional unit elevation for condensate drains. Ribbed elastomeric pads shall be located in accordance with the air handling unit manufacturer’s recommendations.

2.4 SUSPENDED AIR HANDLING UNITS AND ENERGY RECOVERY UNITS

A. Provide VMC Group model HRS-2 combination spring and elastomeric isolation hanger sized for 2’’ static deflection.

B. If suspended air handling units are furnished with internal vibration isolation option, provide VMC Group model HR elastomeric isolation hangers sized for approximately ½’’ deflection to address high frequency break-out.

2.5 SUSPENDED FANS AND FAN COIL UNITS

A. Provide VMC Group model HS spring hangers sized for 1’’ static deflection.

2.6 PIPING

A. Provide VMC Group model HRS combination spring and elastomeric isolation hangers in mechanical equipment rooms, for a minimum distance of 50 feet from isolated equipment for all chilled water and hot water piping 1-1/2’’ diameter and larger. Isolators shall be sized for the same deflection as the isolators specified for the equipment up to a maximum of 2" deflection for at least the first three piping hangers; the remaining hangers shall have isolators sized for 1" deflection.

B. Floor supported piping is required to be isolated with VMC Group model AW-1 open springs sized for 1’’ deflection.

C. All condenser water piping shall be supported with VMC Group model AW-1 open springs sized for 1” deflection for floor or roof mounted piping and VMC Group model HRS-1 combination spring and elastomeric isolation hangers sized for 1” deflection for suspended piping.

D. Provide line size flexible connectors at supply and return of pumps, chillers, and all other locations indicated on the mechanical drawings and details. Flexible pipe connectors shall be VMC Group model 2800 single sphere EPDM construction and shall include 150 lb. cadmium plated carbon steel floating flanges.

2.7 CORROSION PROTECTION

A. All vibration isolators shall be designed and treated for resistance to corrosion.

B. Steel components: PVC coated or phosphate coated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.

D. The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

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SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Refer to Architectural Sections for additional requirements.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:
1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:
1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.
2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton (Name plate Company Factory location 20 Thompson Road, Branford, Connecticut) or approved equal.
3. Generally, markers shall be located on each side of each and every partition, on each side of every tee, on each side of every valve and/or valve group, on each side of every piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.

4. Provide pipe markers that meet labeling requirements of ASME A13.1 for all refrigerant piping located in areas other than the room or space where the associated equipment is located. Pipe markers shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of the identification lettering shall be 1/2". The pipe identification shall indicate the refrigerant designation and safety group classification of the refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerants, the identification shall also include the following statement: “DANGER – Risk of Fire or Explosion. Flammable Refrigerant.” For any Group B refrigerant, the identification shall also include the following statement: “DANGER – Toxic Refrigerant”.
5. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.
6. Markers shall be colored as indicated below per ASME A13.1.

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply; Chilled Water Return
Hot Water	Reddish Orange	Hot Water Supply; Hot Water Return
Condenser Water	Green	Condenser Water Supply; Condenser Water Return
Compressed Air	Blue	Compressed Air
Pneumatic Control	Yellow	Pneumatic Controls
Oxygen	Yellow	Oxygen
Nitrogen	Green	Nitrogen
Deionized Water	Green	Deionized Water
Steam	Yellow	Steam Supply; Steam Return

C. Pipe Painting:
1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.
2. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

SYSTEM	COLOR
Condenser Water Supply and Return	Light Green
Chilled Water Supply and Return	Light Blue
Heating Hot Water Supply and Return	Reddish Orange

2.2 EQUIPMENT IDENTIFICATION

A. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal with minimum 1/2 inch high letters manufactured by Seton Company or approved equal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All labeling equipment shall be installed as per manufacturer’s printed installation instructions.

B. Provide printable label on ceiling grids and access doors at all locations that provide access to mechanical equipment, valves, motorized dampers, and accessories located above ceiling. The label shall be white with black text with 1/4 inch high letters and shall identify the component that is accessible at that location.

C. Provide printable label on ceiling grids and access doors at all locations that provide access to fire dampers, smoke dampers, and combination fire/smoke dampers located above ceiling. The label shall be white with red text with 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, or FIRE DAMPER to identify the damper type that is accessible at that location.

D. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturer’s requirements.

E. All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Refer to Division 9 for Architect’s required paint system(s).

END OF SECTION

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 RELATED DOCUMENTS

A. Approved submittal date on equipment installed, to accomplish the test procedures, outlined under paragraph 3.01 of this Section, will be provided by the Contractor.

1.3 DESCRIPTION

A. The TAB of the air conditioning systems shall be performed by an impartial technical firm hired by the Owner whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B. The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various Subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.4 QUALITY ASSURANCE

A. QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B. QUALIFICATIONS OF TAB FIRM PERSONNEL:
1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.
2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.
3. Evidence shall be submitted to show that the personnel who actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C. CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges, thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SERVICES OF THE CONTRACTOR

A. The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. Install these devices in a manner that leaves them accessible, and provide access as requested by the TAB firm.

B. Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Architect and Owner that such a condition exists.

C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D. Fully examine the existing system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit have individually adjustable volume regulating dampers.

F. Provide, correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.

G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H. Project construction schedules shall provide time to permit the successful completion of TAB services prior to Substantial Completion. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:
   1. Construction status of building shall permit the closing of doors, windows, ceilings installed and penetrations complete, to obtain project operating conditions.
   2. AIR DISTRIBUTION SYSTEMS:
      a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
      b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
      c. Supply, return, exhaust and transfer grilles, registers and diffusers shall be installed.
      d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.
      e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.
      f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.
   3. WATER CIRCULATING SYSTEMS:
      a. Position valves pertinent to system design and require operation to permit full flow of water through system components. Operate hydronic systems under full flow conditions until circulating water is clean. Remove and clean strainers as required during this cycle of operation.
      b. For retrofit projects, record each existing pump motor amperage and voltage. Readings shall not exceed nameplate rating.

c. Verify, on new equipment, electrical starter overload heater elements to be of proper size and rating.
d. Ensure that water circulating systems shall be full of water and free of air; expansion tanks set for proper water level, and air vents installed at high points of systems and operating freely. Advise Engineer of deficiencies.
e. Check and set operating temperatures of heat exchangers to design requirements.
f. The various existing water circulating systems, including existing strainers, shall be cleaned, filled, purged of air, and put into operation before hydronic balancing.

4. AUTOMATIC CONTROLS:
   a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.
   b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.
   c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Engineer of deficiencies or malfunctions.

I. Contractor shall repair any insulation removed from piping system by TAB Contractor during water balancing.

3.2 SERVICES OF THE TAB FIRM

A. The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The reinspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B. Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Engineer complete reports on the balance and operations of the systems.

C. Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

F. Contractor shall utilize ultrasonic flow meter to balance water flow of existing water system if the original pressure drop data is not available. Contractor shall remove insulation as necessary to use flow meter.

G. Participate in the commissioning process, which shall include but not be limited to attending commissioning meetings, coordinating work with and completing checklists as required by the commissioning team.

3.3 PROFESSIONAL REPORT

A. Before the final acceptance of the report is made, the TAB firm will furnish the Engineer the following data to be approved by the Owner and Engineer:
   1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.

2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
3. Air quantities at each return and exhaust air handling device.
4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems. Including the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.
5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.4 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL:
1. Place all equipment into full operation, and continue operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Contractor shall return to rebalance air side system as required to put system in proper balance at that season.
2. The Contractor shall submit detailed balancing and recording forms for approval. After approval by the Engineer, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.
3. Upon completion of the balancing and testing, the TAB Contractor shall compile the test data in report forms, and forward five copies to the Engineer for evaluation.
4. The final report shall contain logged results of all tests, including such data as:
   a. Tabulation of air volume at each outlet.
   b. Outside dry bulb and wet bulb temperature.
   c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
   d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B. AIR SYSTEMS: Perform the following operations as applicable to balance and test systems:
1. Check fan rotation.
2. Check filters (balancing shall be done with clean filters).
3. Test and adjust blower rpm to design requirements.
4. Test and record motor full load amperes.
5. Test and record system static pressures, suction and discharge.
6. Test and adjust system for design cfm, return air and outside air (±2%). Change-out fan sheaves as required to balance system.
7. Test and record entering air temperatures, db and wb.
8. Test and record leaving air temperatures, db and wb.
9. Adjust all zones to design cfm (±2%).
10. Test and adjust each diffuser, grille, and register to within 5% of design.

C. AIR DUCT LEAKAGE: (From SMACNA Duct Standards latest edition) Test all ductwork (designed to handle over 1000 CFM) as follows:
1. Test apparatus
   a. The test apparatus shall consist of:
   b. A source of high pressure air - a portable rotary blower or a tank type vacuum cleaner.
   c. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.
2. Test Procedures
   a. Test for audible leaks as follows:
      1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
      2) Start the blower with its control damper closed.

3) Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
4) Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
1) Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.

D. DX SYSTEMS:
1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
2. Test and record unit full load amps and voltage.
3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E. Automatic temperature controls shall be calibrated; and all thermostats and dampers adjusted so that the control system is in proper operating condition, subject to the approval of the Engineer/Owner.

F. The TAB Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION

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SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. External Duct Insulation
1. Fiberglass / Glass Mineral Fiber Flexible Blanket Insulation
2. Fiberglass / Glass Mineral Fiber Rigid Board Insulation
3. Fiberglass / Glass Mineral Fiber Segmented Board Pipe and Tank Insulation
4. Fiberglass / Glass Mineral Fiber Continuous Mat Pipe and Tank Insulation
5. Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation

B. Internal Duct Insulation
1. Fiberglass / Glass Mineral Fiber Flexible Duct Liner Insulation
2. Fiberglass / Glass Mineral Fiber Rigid Plenum Liner Insulation

C. Adhesives

D. Mastics

E. Lagging Adhesives

F. Sealants

G. Glass Fiber Fabric Reinforcing Mesh

H. Securements

1.3 RELATED SECTIONS

A. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B. Section 23 05 53 - Identification for HVAC Piping and Equipment

C. Section 23 31 13 - Metal Ductwork

1.4 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

E. ASTM C165 - Standard Test Method for Measuring Compressive Properties of Thermal Insulations; 2023.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

G. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

H. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2016 (Reapproved 2021).

I. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks; 2019.

J. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).

K. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation; 2021.

L. ASTM D1644 - Standard Test Methods for Nonvolatile Content of Varnishes; 2001.

M. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.

N. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

O. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

P. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

Q. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

R. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

S. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

T. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

V. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

W. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

X. ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria; 2023.

Y. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Z. MIL-DTL-3316 - Adhesives, Fire-Resistant, Thermal Insulation; 2020d.

AA. NAIMA FGDLS - North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards; Current Edition, Including All Revisions.

BB. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

CC. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

DD. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

EE. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

FF. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers; Current Edition, Including All Revisions.

GG. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

HH. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.
   1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of ICC (IECC) and ASHRAE Std 90.1 I-P unless greater values are indicated otherwise in the contract documents.

D. Adhesive and other insulation materials shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

E. Vapor retarder mastics used on the interior of the building shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D

F. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.

G. Fiberglass insulations shall have a minimum of 50 percent recycled glass content.

H. Fiberglass insulations shall have a formaldehyde-free binder and shall be UL GREENGUARD Gold certified.

1.6 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Mildewing.
   2. Peeling, cracking, and blistering.
   3. Condensation on exterior surfaces.

1.7 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation materials to site in unopened containers with manufacturer's product name, ASTM standard designation, type and grade, maximum use temperature, nominal dimensions, manufacturer lot or date code.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

B. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the Work.

C. Internal lining shall be provided for sound attenuation only. Provide internal lining for all discharge ductwork coming out of the AHU's for a minimum of 15' downstream of the outlet.

2.2 ACCEPTABLE MANUFACTURERS

A. Fiberglass/Glass mineral fiber materials shall be as manufactured by Knauf Insulation, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor retarder, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives, mastics, and sealants shall be as manufactured by 3M Company, Carlisle/Hardcast, Design Polymerics, Foster/Childers, Mon-Eco Industries, or Vimasco Corporation and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Ceramic fiber materials shall be as manufactured by 3M Company, Alkegen/Unifrax, or Morgan Advanced Materials/Thermal Ceramics.

D. Metal jacketing and fitting covers shall be as manufactured by Johns Manville or RPR Products, Inc.

2.3 EXTERNAL INSULATIONS

A. Fiberglass / Glass Mineral Fiber Flexible Blanket Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1290 and ASTM C553, Type I, II, and III. Provide insulation with factory applied FSK vapor retarding facing complying with ASTM C1136, Type I, II, VIII, X. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.27 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 250 degrees F with facing, 350 degrees F for unfaced material. Provide Knauf Insulation Atmosphere Duct Wrap with ECOSE Technology, Johns Manville Microlite FSK or approved equal.

B. Fiberglass / Glass Mineral Fiber Rigid Board Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C553 Type I, II, III, ASTM C612 Type IA, IB. Provide insulation with factory applied FSK facing vapor retarder facing complying with ASTM C1136, Type I, II. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.24 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 450 degrees F. Provide Knauf Insulation Earthwool Insulation Board with ECOSE Technology, Johns Manville 800 Series Spin-Glas or approved equal.

C. Fiberglass / Glass Mineral Fiber Segmented Board Pipe and Tank Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1393, Category 1. Semi-rigid, segmented board in roll form with glass fibers adhered perpendicular to the vapor retarder facing. Provide insulation with factory applied FSK vapor retarder facing complying with ASTM C1136, Type II, IV, X. Compressive strength per ASTM C165 C165, not less than 120 PSF at 10% deformation. Thermal conductivity (k-value) at 100 degrees F mean temperature shall be 0.26 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 850 degrees F. Provide Knauf Insulation Earthwool Pipe & Tank Insulation with ECOSE Technology or approved equal.

D. Fiberglass / Glass Mineral Fiber Continuous Mat Pipe and Tank Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1393; Type I, II, IIIA, IIIB Category 2. Semi-rigid, continuous mat in roll form. Provide insulation with factory applied FSK vapor retarder facing complying with ASTM C1136, Type II, IV, X. Compressive strength per ASTM C165, not less than 25 PSF at 10% deformation. Thermal conductivity (k-value) at 100 degrees F mean temperature shall be 0.25 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 850 degrees F. Provide Knauf Insulation KwikFlex Pipe & Tank Insulation, Johns Manville Micro-Flex or approved equal.

E. Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation: High-temperature ceramic fiber blanket thermal insulation encapsulated in a fiberglass reinforced aluminized polyester foil. Fire-rated blanket insulation shall have a nominal thickness of 1-1/2” and a nominal density of 6.0 pcf. Provide 3M Fire Barrier Duct Wrap 615+, Alkegen/Unifrax FyreWrap Elite 1.5, or Morgan Advanced Materials/Thermal Ceramics FireMaster FastWrap XL.

2.4 INTERNAL INSULATIONS

A. Fiberglass / Glass Mineral Fiber Flexible Duct Liner Insulation: Rotary glass fibers bonded with thermosetting resin, complying with ASTM C1071 Type I. Airstream side to have a tightly bonded, black mat finish withstanding maximum rated air velocity of 6,000 ft/minute. Mat finish shall be treated with EPA-registered biocide for use in HVAC systems and verified to be microbially resistant in accordance with ASTM G21, ASTM G22, ASTM C1338, and UL 2824. The outer edges of the Liner shall have a factory applied encapsulating coating. Nominal density shall be 1.5 pcf minimum and when tested in accordance with ASTM C423 (Type A Mounting), shall provide a Noise Reduction Coefficient of 0.70 at 1.0”, 0.80 at 1.5”, and 0.95 at 2.0” thickness. Maximum service temperature of 250 degrees F. Thermal Conductivity (k-value) at 75 degrees F mean temperature shall be 0.24 Btu x in. /h x sq. ft. x degrees F, or less. Provide Knauf Insulation Atmosphere Duct Liner with ECOSE Technology, Johns Manville Linacoustic RC or approved equal.

B. Fiberglass / Glass Mineral Fiber Rigid Plenum Liner Insulation: Glass fibers bonded with thermosetting resin, complying with ASTM C1071 Type II. Airstream side to have a tightly bonded, black mat finish withstanding maximum rated air velocity of 5,000 ft/minute. Mat finish shall be treated with EPA-registered biocide for use in HVAC systems and verified to be microbially resistant in accordance with ASTM G21 and ASTM C1338. The outer edges of the Liner shall have a factory applied encapsulating coating. Nominal density shall be 3.0 pcf minimum and when tested in accordance with ASTM C423 (Type A Mounting), shall provide a minimum Noise Reduction Coefficient of 0.65 at 1.0", 0.85 at 1.5", at 0.95 at 2.0" thickness. Maximum service temperature of 250 degrees F. Thermal Conductivity (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Provide Knauf Insulation Atmosphere Rigid Plenum Liner with ECOSE Technology, Johns Manville Linacoustic R-300 or approved equal.

2.5 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Fiberglass / Glass Mineral Fiber Adhesive: Comply with MIL-DTL-3316C, Class 2, Grade A. Provide Childers CP-82 or approved equal.

C. Duct Liner Adhesive: Duct Liner adhesives shall comply with ASTM C916.

2.6 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic: Water based; suitable for indoor and outdoor use on below ambient services. Water-Vapor Permeance shall be 0.09 perms at 55-mils dry film thickness when tested in accordance with ASTM E96/E96M, Procedure A. Service Temperature Range shall be -20 to +180 degrees F. Solids content shall be 59 percent by volume and 71 percent by weight per ASTM D1644. Provide Childers CP-35 or approved equal.

2.7 LAGGING ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation. Service Temperature Range shall be 0 to +180 degrees F. Provide Childers CP-52 or approved equal.

2.8 SEALANTS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

B. FSK and Metal Jacket Flashing Sealants shall be fire and water-resistant, flexible, elastomeric sealants with a service temperature range of -40 to +250 degrees F. Provide Childers CP-76 or approved equal.

C. Fire Barrier Sealant shall be a latex-based, intumescent sealant that dries to form a monolithic firestop seal. Fire barrier sealant shall be firestop tested up to 4 hours in accordance with ASTM E814 and fire resistance tested in accordance with ASTM E1966. Provide 3M CP 25WB+ or approved equal.

2.9 GLASS FIBER FABRIC REINFORCING MESH

A. Woven Glass Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch. Provide Childers Chil-Glas No. 10 or approved equal.

2.10 SECUREMENTS

A. Bands
1. Approved Manufacturers
   a. Childers
   b. PABCO
   c. RPR Products
2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B209/B209M, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins
1. Approved Manufacturers
   a. AGM Industries, Inc.
   b. Midwest Fasteners, Inc.
   c. GEMCO
   d. Duro-Dyne
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, minimum 0.106-inch-diameter shank, length to suit depth of insulation indicated.
4. Insulation Retaining Washers: Self-locking washers formed from 0.016 inch thick, galvanized steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Staples
1. Outward-clinching insulation staples, nominal 1/2-inch-wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 GENERAL

A. To ensure that external fiberglass/glass mineral fiber flexible blanket and rigid board insulation will achieve its highest possible performance and serve its intended purpose, install all mechanical insulation materials and associated accessories in accordance with manufacturer’s published instructions and industry practices detailed by the North American Commercial and Industrial Insulation Standards (NACIIS) Manual as published by the Midwest Insulation Contractors Association (MICA).

B. To ensure that internal fiberglass/glass mineral fiber flexible duct and rigid plenum liner insulation will achieve its highest possible performance and serve its intended purpose, install duct liner, plenum liner, and all associated accessories in accordance with manufacturer’s published instructions and industry practices detailed by NAIMA FGDLS and SMACNA (DCS).

C. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

D. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of, ducts and fittings.

E. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.2 EXTERNAL DUCT INSULATION

A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B. Seal all joints, fastener penetrations and other breaks in vapor retarder with 3-inch wide strips of glass fiber fabric reinforcing mesh embedded between two coats of vapor retarder mastic.

C. External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. External duct wrap is also required on all exhaust and relief air ducts that are used in airside energy recovery systems. Any exhaust ductwork located in an unconditioned space that conveys air from conditioned spaces or vice versa shall also be provided with external duct wrap. Duct wrap shall be provided as follows:
   1. 1½” thick, 1.0 pcf density minimum; minimum installed R-value of 4.5 when ducts are located in directly conditioned spaces.
   2. 2” thick, 1.0 pcf density minimum; minimum installed R-value of 6.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air or located indoors concealed within chases or shafts.
   3. 3" thick, 0.75 pcf density minimum; minimum installed R-value of 8.3 when ducts are located in unconditioned spaces.

D. Any ductwork located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 or UL 723 testing requirements or UL 2043 for discrete products in plenums shall be provided with a single layer of duct wrap to establish a noncombustible rating per ASTM E136. Duct wrap products which are approved for such non-compliant combustible duct materials located in air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Alkegen/Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

3.3 DUCT LINER

A. Duct liner shall be kept clean and dry during transportation, storage, installation, and throughout the construction process care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

B. Duct liner shall be adhered to the sheet metal with a full coverage of approved adhesive complying with ASTM C916. All exposed leading edges and transverse joints shall be coated with factory-applied or field-applied edge coating, Childers CP-50A HV2 Black or approved equal and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with an edge coating. All coatings and adhesives shall be designed for duct liner application.

C. Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct.

D. When velocity exceeds 4,000 fpm (20.3 m/sec), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.

E. Line supply and return ductwork at connection of fan-powered HVAC units to a point of 15 feet upstream and downstream of the equipment, 15 feet downstream of fan powered terminal units, and in return air boots.

F. Duct liner shall be provided as follows:
   1. 1” thick, 1.5 pcf density minimum, with a minimum installed R-value of 4.2 when ducts are located in directly conditioned spaces.
   2. 1 ½” thick, 1.5 pcf density minimum, with a minimum installed R-value of 6.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air.
   3. 2” thick, 1.5 pcf density minimum, with a minimum installed R-value of 8.0 when ducts are located in indoor, unconditioned spaces or located outdoors.

4. 1 ½" thick, 3.0 pcf density minimum, with a minimum R-value of 6.3 for rigid plenum liner applications.

3.4 EXPOSED DUCTWORK LOCATED INDOORS

A. Duct required to be insulated by any section of this specification that is routed exposed in occupied spaces shall be double wall.

B. Duct routed exposed shall be double wall with perforated inner liner and fiberglass/glass mineral fiber insulation. Provide 1" thick insulation when ductwork is located in conditioned spaces and 2" thick in unconditioned spaces, insulation density shall be a minimum of 1.0 pcf. Double wall duct shall be United McGill model Acousti-k27 for round or oval ducts and Rectangular-k27 for rectangular ducts or approved equal.

3.5 EXPOSED DUCT LOCATED OUTDOORS OR IN UNINHABITED CRAWLSPACES

A. All rectangular metal ductwork located outdoors or in uninhabited crawlspaces shall be internally lined with fiberglass Duct Liner as specified and externally insulated with 2" thick, 6.0 pcf density fiberglass insulation board with FSK facing. The protective finish system shall be aluminum jacketing complying with ASTM C1729. The aluminum layer of the jacketing shall be 0.016" minimum thickness.

B. All round and flat oval metal ductwork located outdoors or in uninhabited crawlspaces shall be internally lined with fiberglass Duct Liner as specified and externally insulated with 2" thick fiberglass pipe and tank insulation with FSK facing. The protective finish system shall be aluminum jacketing complying with ASTM C1729. The aluminum layer of the jacketing shall be 0.016" minimum thickness.

C. Paint non-insulated duct. Coordinate color with Architect.

3.6 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A. The backside of all supply air devices shall be insulated with taped and sealed external duct wrap matching the thickness, density, and R-value of the associated duct system.

B. The contractor shall install an additional layer of 1-½ inch thick external fiberglass / glass mineral fiber duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and vapor-sealed and located until all evidence of the condensation has been eliminated, at no additional cost to the Owner.

3.7 KITCHEN GREASE HOOD EXHAUST DUCT

A. All type I kitchen range hood exhaust duct shall be enclosed with 2-hour fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant. Refer to Division 7 for further requirements regarding ""Through-Penetration Firestop Systems".

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use two layers of 2-hour Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:
   1. Duct insulation system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 2 hours.
   2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).
   3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.

4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F. Insulation and all other requirements shall be provided per local codes.

3.8 DRYER VENT DUCT

A. All dryer vent duct routed within an air plenum shall be enclosed within a 1-hour fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant. Refer to Division 7 for further requirements regarding ""Through-Penetration Firestop Systems".

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use two layers of 2-hour Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:
1. Duct insulation system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 1 hour.
2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).
3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.
4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F. Insulation and all other requirements shall be provided per local codes.

END OF SECTION

SECTION 23 07 16

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Work specified elsewhere.
1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

F. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

A. Installer’s Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

C. All HVAC equipment insulation shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

D. Adhesives and other materials shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed before any insulation is installed.

C. A sample quantity of each type of insulation and each type application shall be installed and reviewed prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

F. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

END OF SECTION

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SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Furnish and install piping insulation to:
1. Chilled water and heating hot water piping.
2. Condensate drain piping.
3. Refrigerant piping.
4. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.
1. Painting.
2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B. Section 23 05 53 - Identification for HVAC Piping and Equipment

C. Section 23 21 13 - Above Ground Hydronic Piping

1.4 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

C. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:
1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 HVAC PIPING INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed prior to installation.

C. A sample quantity of each type of insulation and each type application shall be installed and accepted prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.
   1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

E. All HVAC piping insulation thicknesses shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.2 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Flexible elastomeric cellular thermal insulation by Armacell.

E. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

F. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.3 MATERIALS

A. CHILLED WATER PIPING: Provide phenolic foam in accordance with ASTM C1126 with ASJ jacket and all joints sealed.

B. HEATING HOT WATER PIPING: Provide glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket or phenolic foam in accordance with ASTM C1126 with ASJ and all joints sealed.

C. CONDENSATE DRAINAGE PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultima", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

D. REFRIGERANT PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M. Provide model "Armaflex Ultima", fire rated for use in environmental air plenums for all indoor applications. Provide model "AP Armaflex", for all outdoor applications. Apply manufacturers recommended finish and sealant for outdoor applications.

E. METAL JACKETING: Utilize Childers “Strap-On” jacketing. Provide preformed fitting covers for all elbows and tees.

F. ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed; complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

C. All heat recovery piping between air conditioning equipment and hydronic or domestic hot water piping shall be insulated per the High Temperature Surfaces Schedule below.

D. All condenser water piping located in a ceiling plenum shall be insulated per the requirements for indoor chilled water piping as indicated in the Low Temperature Surfaces Schedule below.

E. Pipes located outdoors or in tunnels shall be insulated same as concealed piping and shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All insulation butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

F. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

G. Provide all HVAC piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.
   1. Minimum Insulation Thickness for Low Temperature Surfaces
      a. Condensate drain lines: 1 inch
      b. Chilled Water Piping:
         1) Located outdoors: 2 inch
         2) Located indoors:
            a) 4 inch and smaller: 1-½ inch
            b) Larger than 4 inch: 2 inch
      c. Refrigerant Piping
         1) 1½“ and smaller: 1 inch
         2) Larger than 1½ inch: 1-½ inch
   2. Minimum Insulation Thickness for High Temperature Surfaces
      a. Hot Water Piping:
         1) Operating temperature 105°F or less: 1 inch
         2) Operating temperature higher than 105°F and pipe size 1-¼ inch or smaller: 1-½ inch
         3) Operating temperature higher than 105°F and pipe size greater than 1-¼ inch: 2 inch
      b. Steam Piping:
         1) Pipe size 1-½ inch and smaller: 2-½ inch
         2) Pipe size more than 1-½ inch: 3 inch

c. Refrigerant Piping
   1) 1-½ inch and smaller: 1-½ inch
   2) Larger than 1-½ inch: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass mineral wool covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the joint is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder mastic shall be applied to all edges of the vapor retarder jacket.

3.3 STANDBY-GENERATOR ENGINE EXHAUST PIPING

A. Entire engine exhaust pipe from exhaust manifold to outside terminal shall be enclosed in a 1" thick layer of calcium silicate insulation.

B. A second insulating layer of 1" thick calcium silicate shall cover the first layer.

C. Joints for the first and second layer shall be staggered.

D. Apply aluminum jacket over outer layer of insulation.

E. Insulate exhaust muffler in the same manner as the exhaust piping.

3.4 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B. The penetration shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION

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SECTION 23 08 00

COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS:

A. Section 01 91 00 - General Commissioning Requirements

B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

A. The commissioning of the HVAC system and associated controls shall be performed by an impartial technical firm hired by the owner. The commissioning provider shall be certified under one or more of the following certifications:
   1. CxA - Certified Commissioning Authority - ACG
   2. CBCP - Certified Building Commissioning Professional - AEE
   3. CCP - Certified Commissioning Professional - BCA
   4. CPMP - Certified Process Management Professional - ASHRAE
   5. BSC - Building System Commissioning Certification - NEBB

B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

A. Contractor: Responsibilities of the Contractor as related to the Commissioning Process include, but are not limited to the following:
   1. Facilitate coordination of Commissioning work by Commissioning authority.
   2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
   3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
   4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.
   5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
   6. Provide Testing and Balancing Report before Functional Testing begins.
   7. Provide As-built drawings and documentation to facilitate Testing.
   8. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
   9. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
   10. Install systems and equipment in strict conformance with project specifications, manufacturer’s recommended installation procedures, and Pre-Functional Checklists.
   11. Provide data concerning performance, installation, and start-up of systems.
   12. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

13. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
14. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
15. Provide qualified personnel to assist and participate in Commissioning.
16. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
17. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Test Engineer in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
18. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
19. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
20. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
21. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
22. Coordinate and provide training of Owner's personnel.
23. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority comments.
24. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B. Subcontractors and vendors shall prepare and submit to Commissioning authority proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority

1.5 COMMISSIONING PLAN

A. Commissioning Process tasks and activities:
1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.
3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.
4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications. Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions (including all alarms). Controls system shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with the plans and specifications. Sequences shall be functionally tested to document they operate in accordance with plans and specifications.
5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.

6. Air and hydronic system balancing: Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the contract documents. System balancing shall be performed by TAB contractor as specified in 23 05 93 - Testing, Adjusting, And Balancing.
7. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
8. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B. Equipment to be tested
1. Energy Management and Control System:
   a. Graphical User Interface
   b. Automation Software
   c. Field Level Controllers
   d. Field Level Devices
   e. Control Sequences
2. Chilled Water Systems (All chillers and pumps)
3. Condenser Water Systems (All towers and pumps)
4. Heating Water Systems (All boilers and pumps)
5. Air Handling Systems (All AHU and 10% of terminal units)
6. Energy Recovery Systems (100%)
7. Water Treatment Systems (Verify vendors completion of scope)
8. Service water heating systems (100%)

C. Testing functions and conditions
1. Energy conservation programs (economizer, optimal start, etc)
2. Verify shutdown of systems when scheduled.
3. Calibration of sensors
4. Testing shall affirm winter and summer design conditions.
5. Test under full outside air conditions.
6. Confirm functionality of all specified sequences of operations.
7. Verify the functionality of all alarms.

D. Performance criteria
1. Air and water temperatures shall be within tolerances specified in the contract documents.
2. Space temperatures shall be maintained within 1 degree of specified set points.
3. Space humidity shall be maintained within 5% of specified levels.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

A. Complete all phases of the work so the systems can be started, adjusted, balanced, tested, and otherwise tested.

B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C. Assist commissioning authority with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E. A minimum of 7 days prior to date of system startup, submit to Commissioning authority for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor’s responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division’s systems.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

C. Refer to commissioning plan for detailed list of equipment to be commissioned.

D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E. DBR has included a small contingency for limited retesting, however DBR reserves the right to stop testing on a system when the system:

1. Does not have the correct graphics programmed.
2. Does not have the correct data trends programmed.
3. Does not have the correct set points programmed.
4. Does not have the equipment or system safeties installed and programmed correctly.
5. The TAB data forms have not been submitted to our firm or the performance of the system listed on the TAB forms is not per project requirements.
6. Line items of the functional performance test have failed.

F. Sampling
1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
3. A common sampling strategy is the “xx% Sampling - yy% Failure Rule”, defined by the following example.
   a. xx = the percent of the group of identical equipment to be included in each sample.
   b. yy = the percent of the sample that if failing, will require another sample to be tested.
   c. The example below describes a 20% Sampling - 10% Failure Rule.
   d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
   e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
   f. If 10% of the units in the second sample fail, test all remaining units in the whole group.
   g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

G. Re-Testing And Failure To Remedy Deficiencies
1. Despite Contractor’s best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is Contractor’s responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is Contractor’s responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
   a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor’s control to resolve expeditiously.
   b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor’s request.
   a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA’s expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

H. Deferred Testing
1. "Seasonal Commissioning” pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.

3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C. The training agenda (plan) shall include, at a minimum, the following elements:
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.

D. Commissioning authority shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning authority with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Sub-Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority copy of O&M manuals shall be submitted through Architect.

D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

A. Commissioning authority shall provide documentation of process as follows:
1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

SECTION 23 09 63

ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS)

PART 1 - GENERAL

1.1 GENERAL

A. The Energy Management and Control System (EMCS) shall be comprised of a Local Area Network (LAN) infrastructure, Operator Workstations (OWS), Engineering Workstations (EWS), a Primary Network Server (PNS), Network Area Controllers (NAC), Application Specific Controllers (ASC), Unitary System Controllers (USC), and Field Devices installed within the facility. The EMCS Contractor shall provide a completely wired system. Wireless components and wireless communication are not acceptable.

B. The Workstations, Primary Network Server, and Network Area Controllers shall be connected by a EMCS Contractor supplied and installed Local Area Network. The LAN shall comply with all IEEE Standards as outlined in the latest revision of IEEE 802: Local and Metropolitan Networks: Overview and Architecture.

C. If the EMCS contractor wishes to connect to the Owner's Wide Area/Local Area Network as part of the control system network, the EMCS contractor shall acquire permission in writing and include the letter in the submittal. Any system that requires connection to the owner's network for communication between NAC, ASC, USC and/or field devices that is submitted without the written permission from the owner shall be rejected. The EMCS Contractor shall coordinate with the Owner and supply all required information.

D. Access to the system, either locally in the building, or remotely from a central site or sites, shall be accomplished through standard web browsers, via the Internet and/or a local area network.

E. All EMCS controllers and workstations shall communicate using the protocols and network standards as defined by ASHRAE Std 135, latest revision. Management level TCP/IP Ethernet network speeds shall be 1 Gbps minimum and the Automation Level MS/TP network speeds shall be 76.8 Kbps minimum.

F. The Server shall gather data from the system and generate HTML pages accessible through a conventional web browser from all personal computers (PCs) connected to the network. System shall include any and all software and hardware to support at least 50 simultaneous users. The EMCS shall be compatible with all common web browsers.

G. Facility Operators shall be able to view and configure systems through the standard web browser and all graphical/data representations shall appear identical, whether the user is on site or viewing via the Internet at a remote location. Standard operator functions such as control point manipulation, configuration and viewing of trends, schedules and alarms shall be performed through the standard browser. Each mechanical system and building floor plan shall be depicted on the operator workstation by point-and-click graphics.

H. The EMCS shall directly control HVAC equipment as specified in the Sequence of Operations. Furnish Energy Conservation features such as Optimal Start/Stop, Night Setback, Setpoint Reset logic, and Demand Control Ventilation.

I. The EMCS vendor shall provide the following additional services as part of this specification: warranty and service during the warranty period; submittals, samples and record documentation; comprehensive startup and testing of the EMCS with documentation; training services for the owner and facility operators; coordination with other contractors and suppliers; operator and technician training program, and shall cooperate fully with the Project Commissioning Agent.

J. Products furnished under this specification but installed by others.
   1. Mechanical devices installed under Division 23 by the mechanical contractor or other suppliers:
      a. Temperature sensing thermowells.
      b. Automatic control valves and actuators.
      c. Pipe taps for flowmeters.

d. Water pressure sensors and switches.
e. Automatic control dampers and actuators not installed in air handling unit mixing boxes or louvers.
f. Damper actuators for automatic control dampers installed in air handling unit mixing boxes.
g. Damper actuators for variable air volume (VAV) terminal units.
h. Mounting cost of controller and actuator for variable air volume (VAV) terminal units.

2. Electrical devices installed under Division 26 by the electrical contractor:
   a. 120 VAC power to controllers and control panels at locations indicated on the drawings. Review and verify that these locations are adequate for the proposed EMCS.
   b. Interlock wiring to duct mounted smoke detector or fire alarm shutdown relays to HVAC equipment motor starters and variable frequency drives (VFD).

K. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

1.2 RELATED DOCUMENTS & REFERENCES

A. Drawings and general provisions of the contract documents, apply to this section including:
1. Division 01 for General Conditions and Supplementary Conditions.
2. Division 21 for fire protection equipment.
3. Division 22 for plumbing equipment and domestic water systems.
4. Division 23 for mechanical equipment, ductwork, and piping systems.
5. Division 26 for electrical equipment, lighting control, and fire alarm systems.

B. The latest edition of the following standards and codes in effect as approved by the authority having jurisdiction and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
1. ANSI MC85.1 - Terminology for Automatic Control.
2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
3. ASHRAE Std 135 - BACnet.
4. BTL Mark by the BACnet Testing Laboratories.
5. Uniform Building Code (UBC), including local amendments.
6. UL 916 - Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
7. NFPA 70, National Electrical Code (NEC).
8. FCC Part 15, Subpart J, Class A.
9. National Institute of Standards and Technology (NIST).
10. IEEE 802: Local and Metropolitan Networks: Overview and Architecture.

1.3 RELATED WORK IN OTHER SECTIONS

A. Refer to Division 00 and Division 01 for allowances and related contractual requirements.

B. Refer to Division 21 for General Fire Protection Provisions and fire suppression pump.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

C. Refer to Division 22 for General Plumbing Provisions, domestic water heating systems, domestic water pumping systems, domestic water metering, and natural gas metering.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

D. Refer to Division 23 for General Mechanical Provisions for equipment such as chillers, cooling towers, boilers, pumps, air-handling units, terminal units, ventilation fans, variable frequency drives, unitary AC units, etc.

1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

E. Refer to Division 26 for General Electrical Provisions for equipment such as electrical switchgear control, electrical power monitoring, emergency generators, lighting control system, etc.
1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

1.4 ELECTRICAL POWER PROVISIONS

A. Primary power will be provided under Division 26 by the electrical contractor to the panel locations indicated on the mechanical & electrical drawings. Provide step down transformers within panel enclosures. Provide all necessary fuses and circuit protection devices.

B. Power will be provided to the controllers serving fan powered terminal units with electric heat via the control transformer provided with the unit.

C. All components of the EMCS shall be powered from the sources above. Provide final terminations from the locations indicated on the Division 23 Drawings.

D. The EMCS Contractor shall provide any additional control power that is required as part of this contract and not indicated by other. This shall include all conduit, cabling, circuit breakers, etc.

1.5 CONTRACTOR QUALIFICATIONS

A. The EMCS Contractor shall:
1. Have a local staff of trained personnel capable of giving instructions and providing routine and emergency maintenance on the EMCS, all components and software/firmware and all other elements of the EMCS.
2. Have a proven record of experience in the supply and installation of equivalent BACnet systems over a minimum period of five years. Provide documentation of at least three equal and complexity, if so requested by the Owner’s Representative.
3. Be a factory certified representative of the native BACnet EMCS manufacturer for design, installation, and service of the proposed system.
4. Have comprehensive local service, training and support facilities for the total EMCS as provided. Maintain local, supplies of essential expendable parts.

1.6 SUBMITTALS

A. ALL DOCUMENTS SUBMITTED SHALL BE IN NATIVE PDF FORMAT. NO SCANS.

B. Shop Drawings:
1. The following information shall be included on the cover page for each shop drawing and equipment documentation submittal:
   a. Project name with date. Refer to the applicable specifications by name and number.
   b. Provide submittal number and re-submittal number and date as applicable.
   c. Provided name and address of Consulting Engineer, Mechanical Contractor, General Contractor
2. Shop drawings shall be CAD generated, plot size of 8-1/2” x 11” or 11” x 17”. Drawings shall include diagrams, mounting instructions, installation procedures, equipment details and software descriptions for all aspects of the system to be installed.
3. Provide schematic of systems indicating instrumentation locations, all interconnecting cables between supplied cabinets on a mechanical floor plan.
4. Software specifications and descriptions including operating sequences.

5. Provide a bill of material that indicates specific manufacturer, part number, part description and quantity of each device for all system components.
6. Provide a list of the wire labels to be installed on each end of the control wiring, at the device and the control panel terminal. Labels shall be machine generated, typed and legible with a maximum of 17 characters. The label description “AHU-1 SAT” shall indicate the supply air temperature of AHU-1.
7. Equipment Schematic: Provide an electronic equipment schematic for each piece of mechanical equipment. The schematic shall display all mechanical equipment characteristics including fans, dampers, valves, sensors and other applicable control devices. The schematic shall show wiring terminations to each control device as shown in the submittal and as-build documentation. Control devices shall be labeled by a symbol that can easily be identified in a bill of material that is shown on this graphic. The bill of material shall show the device symbol, description, manufacturer and part number.
8. Sequence of Operations: The control sequences shall be viewable for each piece of mechanical equipment and be in a text format as shown in the as built documentation. The sequence of operations shall be selectable at the applicable location for the control program.

C. Control component submittals:
1. Component technical data sheets with mounting and installation details.
2. The documentation shall include comprehensive and complete details of the BIBB and automation level documentation including address, associated controller type, etc. as required and for the interface to the EMCS.
3. Details of networks/communications equipment, cabling and protocols proposed. Provide schedule of cabling including details of proposed cable types.
4. Module Drawing: Provide an electronic wiring diagram of each control module (as shown in submittal documentation). Diagram shall display wiring schematic and terminations to end devices. Diagram shall display each input and output terminals and label those that are used for the control application. Diagram shall display module type/name and network address.
5. Field sensor and instrumentation specification sheets. Provide complete manufacturer’s specifications for all items that are supplied. Include vendor name of every item supplied.
6. Schedule and specification sheets for dampers, valves and actuators.
7. Design and provide layout of all components of panel mounted control devices, terminal strips and power supplies.

D. Colorgraphics: Provide sample layout of color graphic representations of the systems for review. The submittal shall indicate the quality of the graphic to be provided with the system with a sample of the specific control points to be included. Control points shall as a minimum include points indicated in the input/output summary, control schematic and primary controlling points defined in the sequences of operation. Provide a sample of a floor plan layout, typical AHU, terminal unit, outside air pretreatment unit, variable frequency drive, exhaust/supply fan, chiller plant and hot water plant. For control points to be provided by equipment BACnet integration provide sample of the control points, up to 25 total.

E. Verification Reports: The submittal shall include a sample of the verification reports to be utilized during the verification section of this specification. Sample reports shall be approved as submitted or be modified by the engineer or owner’s representative. The verification reports shall be included in the final Operation & Maintenance Manuals. Reports shall be provided in electronic PDF format.
1. Project Systems Verification Form for each controller.
   a. General information for each form shall include: project name; associated equipment with mark number; control panel number and location; controller number and model number; controller device instance number (address); MS/TP LAN segment number; verifying technician and date.
   b. Each connected control point and device shall contain the following columns with a separate line for each connected physical point: point description (same as device label); input/output number for each connected control device (AI-XX, AO-XX, DI-XX, or DO-XX).
   c. Check boxes confirming that the verification tasks have been completed: device location, proper termination at device; proper termination at control panel; sequence is verified; point trend is enabled.
   d. Data entry boxes indicating measured/confirmed values: preliminary control point value on the graphic; observed control point value; calibration or adjustment value to correct offset; final displayed point value on the color-graphic; date of verification; engineer or owner’s representative verification.
2. Control Panel Verification Form for each control panel.

a. General information: panel location and identification number; panel dimensions and NEMA rating; panel properly installed; Class 1 and Class 2 wiring are properly separated; correct voltage to the panel; no shorts or grounds in panel; no induce voltages in panel wiring; point to point termination match submittal; devices are mounted in the correct location; controller software revision number; address of controllers; panel device checkout is complete; panel startup is complete.

3. Sequence of Operation Verification Form per piece of equipment (AHU, VAV, chiller, boiler, etc.).
   a. General information: project name; system identifier; building area served; control panel and controller numbers; controller model number and instance number (address); MS/TP LAN segment number; name of verifying technician and date.
   b. Each step of the sequence of operation for each piece of equipment shall be documented shall include a “description of test”, “input to trigger test” and “expected outcome”. A pass/fail checkbox shall indicate each of these actions. Provide space for technician approval with associated date.

F. Operating and Maintenance (O&M) manuals: Provide O&M manual with full information to allow the owner to operate, maintain and repair installed products. Include trade names with model numbers, color, dimensions and other physical characteristics.
   1. Format: Produce on 8-1/2 x 11-inch pages, and bind in 3-ring/binders with durable plastic covers. Label binder covers with printed title “OPERATION AND MAINTENANCE MANUAL”, title of project, and subject matter and “Number _ of _” of binder. Provide substantial dividers tabbed and titled by section/component number.
   2. Table of Contents for each volume:
      a. Part 1: Directory with name, address and telephone number of Designer, Contractor and Subcontractors and Suppliers for each Project Manual section.
      b. Part 2: Operation and maintenance instructions, arranged by Project Manual Section number where practical and where not, by system. Include:
   3. Product design criteria, functions, normal operating characteristic and limiting conditions. Installation, alignment, adjustment, checking instructions and troubleshooting guide. Operating instructions for start-up, normal operation, regulation and control, normal shutdown and emergency shutdown. Test data and performance curves.
   4. Spare parts list for operating products, prepared by manufacturers including detailed drawings giving location of each maintainable part, lists of spares recommended for user- service inventory and nearest source of in-stock spares.

G. Record Documentation:
   1. Details of all alarm, diagnostic, error and other messages. Detail the Operator action to be taken for each instance.
   2. Detail special programs provided and provide a complete programming instruction manual. Detail operation of all software applications.
   3. Detailed list of the database for all installed devices.
   4. Record drawings shall be CAD generated and shall include final locations and point ID for each monitored and controlled device.
   5. In additional to the required hard-copies, provide a CD-ROM with all of the record documentation in PDF format and a CD-ROM containing backup copies of all installed software and graphics.
   6. Online as-built documentation: provide digital replications of as-builts that shall be accessible from each equipment graphic controlled or monitored by the EMCS.
   7. As built drawings must be updated to reflect new EMCS configurations.

1.7 WARRANTY

A. Warranty work and the equipment provided under this contract shall be for a period of one year from the date of Substantial Completion. Warranty shall cover all components, system software, parts and assemblies supplied by this contractor and shall be guaranteed against defects in materials and workmanship for one (1) year from the date of Substantial Completion. Labor to troubleshoot, repair, reprogram or replace system components that have failed due to defects in materials and workmanship shall be provided by this contractor at no charge to the owner during the warranty period. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks. All warranty work shall be performed by the EMCS contractor’s local service group.

B. Warranty shall not include routine maintenance, e.g., equipment cleaning, mechanical parts lubrication, pilot lamp replacement, operational testing, etc. Warranty shall not cover repair or replacement of equipment damaged by under- or over-voltage, misuse, lack of proper maintenance, lightning, water damage from weather or piping failure.

C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the EMCS contractor. The maximum acceptable response time to provide this service at the site shall be 24 hours, during normal working hours.

1.8 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 that includes hands-on demonstration of the manipulation of setpoints, schedules and other adjustable elements of the system.
7. The demonstration shall be on the actual, completed graphic interface pages for the specific project.

B. Provide a second training session 3 months after initial session for any follow-up or additional training requested by owner's personnel. Allow 3 hours for the second training session.

1.9 OPERATOR WORKSTATION (OWS)

A. The Operator Workstation shall be any personal computer, connected to the LAN, with appropriate web browser software installed.

1.10 ENGINEERING WORKSTATION (EWS)

A. The Engineering Workstation shall be any personal computer, connected to the LAN, with a registered copy of the EMCS contractor supplied engineering and/or programming software installed. The EMCS contractor shall provide at least one copy of all required software(s), to enable the Owner complete editing/programming functions of all controllers, graphics, and control logic.

B. The EMCS shall provide one personal computer (PC) which is compatible with the performance required by the EMCS Engineering Software if an engineering workstation is specified for the system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE EMCS VENDORS

A. AUTOMATED LOGIC - Branch Office

B. RELIABLE CONTROLS - Unify Energy Solutions - Enviromatic

2.2 PRIMARY NETWORK SERVER (PNS)

A. The EMCS Contractor shall provide and install the Primary Network Server as part of this system. The PNS shall utilize the Internet and provide efficient integration of standard open protocols. The PNS shall maintain comprehensive database management, alarm management and messaging services, and graphical user interface as follows:

1. Support an unlimited number of users over the Internet/intranet with a standard web browser to access alarms, trend logs, graphics, schedules and configuration data. Access to the PNS shall be password protected utilizing authentication and encryption techniques. An audit trail of database changes indicating user, time stamp, and audit action shall be provided.
2. Enterprise level information exchange using an SQL database and HTTP/HTML/XML text formats.
3. Synchronize controller databases, database storage scheduling, control and energy management routines
4. Alarm processing and routing which includes email, SMS text messages and paging.
5. HTML based help system that includes comprehensive online system documentation.
6. Support of multiple Network Area Controllers (NAC) connected to a Local Area Network.

B. Server Functions
1. It shall be possible to access all Network Area Controllers (NAC) via a single connection to the server through the Ethernet LAN. In this configuration, each Network Area Controller can be accessed from a single user login.
2. The PNS shall provide the following functions, at a minimum:
   a. The server shall provide complete access to distributed global data. The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
   b. The server shall include a master clock service for its subsystems and provide time synchronization for all NACs.
   c. The server shall provide scheduling for all NACs and their underlying field control devices.
   d. The server shall provide demand limiting control that operates across all NACs. The network server shall be capable of multiple demand limiting programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
   e. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to NACs. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
   f. The server shall provide central alarm management for all NACs supported by the server. Alarm management shall include: routing of alarms to a video display, a printer, an email and pager; view and acknowledge alarms; query alarm logs based on user-defined parameters
   g. The server shall provide central management of logged data for all NACs supported by the server. Logged data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include: viewing and printing log data; exporting log data to other software applications; query log data based on user-defined parameters
3. The Primary Network Server shall be capable of supporting the following open system drivers;
   a. BACnet/IP
   b. Modbus TCP

C. Network Server Platform Requirements
1. Rack-Mounted Server Computer Hardware: DELL PowerEdge R220 or equal, Intel Xeon Gold 3.0 GHz or higher, 32GB RAM, 2 TB hard drive, video card, 22” color monitor, and Ethernet adapter 1Gbps or higher.
2. Operating system software shall be Microsoft Windows® 10 Professional or higher.

2.3 NETWORK AREA CONTROLLER (NAC)

A. Provide one or more Network Area Controllers (NAC) to meet the sequence of operations and the type and quantity of devices being integrated into the system. The NAC shall provide the interface between the local area network and the field controllers. The NAC shall provide global supervisory control functions over the associated controllers and shall be capable of executing application control programs to provide: calendar functions; scheduling; trending; alarm monitoring and routing; time synchronization; integration of controller data for each applicable protocol; network management functions for all network devices. The user may view real-time information via web-based data.

B. The Network Area Controller shall provide the following hardware features as a minimum: Ethernet Ports 100Mbps or higher, BACnet MS/TP ports, battery backup, DDR RAM memory, flash memory for long term data backup.

C. Provide an uninterruptible power source (UPS) per network controller to maintain operation for 1 hours.

D. The NAC shall be capable of operation over a temperature range of 32 to 122 °F and operation over a humidity range of 5 to 95% RH, non-condensing; storage temperatures of between 32 and 158 °F.

E. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

F. The NAC shall be capable of supporting the following open system drivers;
1. BACnet/IP
2. BACnet MS/TP
3. Modbus TCP
4. Modbus RTU

G. Event Alarm Notification and actions: The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. Alarm conditions shall be routed to any defined user location whether connected to a local or wide-area network.
1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to: alarm; return to normal; fault.
2. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc. Allow timed routing of alarms by class, object, group, or node.
3. Provide alarm generation from binary object “runtime” and/or event counts for equipment maintenance (i.e. filter status, fan run status). Authorized users shall be able to reset runtime or event count values with appropriate password control.
4. Control equipment and network failures shall be treated as alarms and annunciated.
5. Alarms shall be annunciated in any of the following manners as defined by the user: screen message text; e-mail of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on: day of the week, time of day and recipient.
6. Color-graphic shall have flashing alarm object(s). Printed message may be routed directly to a dedicated alarm printer.
7. The following shall be recorded by the NAC for each alarm (at a minimum): time and date; location (building, floor, zone, office number, etc.); associated equipment. Upon acknowledgement of the alarm the NAC shall document the time, date and authorized user. The number of alarm occurrences since the last acknowledgement shall be recorded.
8. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user. Alarm actions may be initiated by user defined programmable objects created for that purpose.
9. Alarm archiving: A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user. Provide a “query” feature to allow review of specific alarms by user defined parameters. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

H. Data Collection and Storage: The NAC shall have the ability to collect data for any property of any object and store this data for future use.
1. The user shall designate the log as an interval log or deviation log. For an interval log, the object shall be configured for time of day, day of week and the sample collection interval. For deviation log, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

2. All log data shall be stored in a relational database in the NAC and the data shall be accessed from the server or a standard web browser. All log data, when accessed from the server, shall be capable of being manipulated using standard SQL statements.
3. All log data shall be available to the user in the following data formats: HTML, XML, plain text, comma separated values, as a minimum.
4. The NAC shall have the ability to archive its log data either locally or remotely to the server or other NAC on the network.

I. Local Access: The NAC shall provide redundancy of system access to the local controllers at the remote building if the Primary Network Server should lose communication or be off-line. The NAC shall maintain setpoint and scheduling features, access to the color-graphic displays, maintain trend logs and reports. Upon restoration of communication with the PNS the archived information shall be transmitted to the server for archiving.

2.4 SOFTWARE FOR THE NAC

A. The distributed architecture of the operating system for the PNS and NACs shall provide the operator a comprehensive interface to allow the operator to configure and customize the EMCS to optimize the HVAC system to save energy, schedule and maintain equipment and provide occupant comfort. The provided graphical toolset shall allow the operator to create applications in a drag and drop environment.
1. Input/output capability shall allow the operator to request the current value or status of the control point; command/override equipment to a specific state; add, change or delete control points, alarm limits and controllers; change descriptors to control points and equipment; modify parameters; create or modify DDC loops.

B. Operator System Access: Via software password with five access levels at workstations and at each control unit.

C. Color graphic tools shall allow the user to create equipment and floor plan graphics from a standard library of symbols; allow custom generation of symbols; utilize over 64 or more colors; create real-time dynamic data for the graphics. Up to 60 control points may be displayed on each graphic.
1. Provide a link between compatible graphics to minimize the paths to additional information. For example, provide the link from the zone sensor to the VAV terminal to the air handling unit and to the central plant. Web pages shall be provided to allow the operator to zoom into specific areas of the facility and then link the space to the floor plan to the overall building and then to the facility site plan.
2. Graphical tools shall allow the creation of bar graphs, pie graphs and other tools to visualize control information such as run time hours, energy consumed and occupant comfort.

D. Alarm processing tools shall allow the operator to create alarm messages that include as a minimum: time of alarm, point descriptor, alarm condition and remote annunciation. Critical alarms shall be displayed, archived to a storage device or printed on a alarm printer. Alarms shall be displayed in order of occurrence and have an optional audible alarm indicator.
1. Print alarm messages, up to 60 characters in length, for each alarm point specified.
2. Alarms may be routed to other devices including web-enabled cell phones, pagers, tablet PCs and designated personal computers on the network or Internet.
3. Operator specifies when alarm requires acknowledgment. Continue to indicate unacknowledged alarms after return to normal. An alarm log shall be maintained to archive alarms for future reference with the above specified parameters as well as indicating the person acknowledging the alarm.
4. The graphical display shall indicate the number of the current unacknowledged alarms by individual building site or by sum of all campus-wide facilities.
5. The operator may create and forward an e-mail message to another user directly from the graphical interface so that the message can be read when the second user logs on to the system.

E. Upon a power failure to equipment in the facility, the EMCS shall automatically start equipment upon the restoration of power. Program a time delay between individual equipment restart on a schedule to minimize demand charges from the utility company.

F. Custom reports may be created by the operator with a requested time and date manually or automatically. All reports may be logged to a storage device for future reference. The data reports shall allow customization and scaling of the X-Y coordinates; plotting of tabular reports; provide multi-point graphical reports with not less than eight variables on the same report. Print reports on daily, weekly, monthly, yearly or scheduled basis as scheduled.

G. The network server current operating system, database, color-graphics, custom reports shall be backed up automatically to a remote server or storage device as directed by the owner's representative.

H. Maintenance Management capability shall allow the system to monitor and log the run-time for HVAC equipment; schedule maintenance reports that include recommended material and labor for the assigned task.

2.5 APPLICATION SPECIFIC CONTROLLERS (ASC)

A. All devices required for single loop control shall be terminated on a single controller. (for example, CHW loop pressure control. The differential pressure sensor and the pump VFD ramp signal.)

B. ASCs shall be capable of implementing control strategies for the system based on information from any or all connected inputs. The AC shall utilize factory pre-programmed global strategies that may be modified by field personnel on-site. Global control algorithms and automated control functions should execute via a 32-bit processor

C. Programming shall be object-oriented using control program blocks that will support a minimum of 500 Analog Values and 500 Binary Values. Analog and binary values shall support standard BACnet priority arrays. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing.

D. Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1 year (cumulative). Battery shall be a field-replaceable (non-rechargeable) lithium type. The onboard, battery-backed real time clock must support schedule operations and trend logs.

E. The base unit of the ASC shall host various I/O combinations including universal inputs, binary outputs, and switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.

F. All binary outputs shall have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. The position of each HOA switch shall be available system wide as a BACnet object.

G. Controller shall be capable of BACnet communication. BACnet Conformance:
1. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.

H. Schedules: Each ASC shall support a minimum of 10 BACnet schedule objects.

I. Logging Capabilities: Each controller shall support a minimum of 100 trend logs. Sample time interval shall be adjustable at the operator's workstation. Controller shall periodically upload trended data to system server for long term archiving if desired. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

J. Alarm Generation: Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures. Alarm logs shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects -system destination and actions individually configurable.

2.6 UNITARY SYSTEM CONTROLLERS (USC)

A. All devices required for single loop control shall be terminated on a single controller. (for example, cooling coil control valve control. The temperature sensor and the valve control signal.)

B. The EMCS Contractor shall provide all Unitary System Controllers. USCs shall be fully programmable or applications specific controllers with pre-packaged operating sequences maintained in Flash RAM.

C. The USC shall be a node on the automation network and shall control its own communications so that the failure of any one node, shall not inhibit communications on the network between the remaining nodes. USCs shall be totally independent of other network nodes for their monitoring and control functions.

D. Provide each USC with a battery back-up for the protection of volatile memory for a minimum of 72 hours. Batteries shall be rated for a seven-year life.

E. All associated applications programs shall reside at the USC. The USC shall not require communication to any other panel for normal operating sequences other than time scheduled base commands.

F. Control shall be based on algorithms, i.e. proportional plus integral plus derivative (PID), proportional plus integral (PI), or proportional to comply with the sequences of operation PID algorithms shall maintain the system operation within +/- 2% of setpoint.

G. The USC shall be configured with sufficient input/output capacity to achieve the required control points to meet the sequence of operations.

2.7 VAV TERMINAL UNIT CONTROLLER (TUC)

A. All devices required for single loop control shall be terminated on a single controller. (for example, terminal unit air valve control. The flow sensor and the actuator control signal.)

B. The EMCS Contractor shall provide all controllers required for all variable air volume (VAV) terminal units. The number and location of terminal units and airflow rates shall be as indicated on the mechanical drawings.

C. The TUC shall be capable of monitoring and controlling the following parameters for VAV terminal units per the sequences of operation and input/output summary: space temperature; primary air flow rate; damper modulation; heating coil stage control, heating valve control, heating SCR control (as applicable); fan on/off control; supply air sensor; occupancy senor; carbon dioxide sensor or humidity sensor.

D. Furnish primary damper actuators, for factory mounting, meeting the following requirements: direct shaft mounting; adequate torque, to properly operate the damper from fully open to fully closed without binding; locking "V" groove or similar means to prevent slippage between actuator and shaft.

E. The EMCS Contractor shall field install the following components for each terminal unit: space temperature sensor; supply air temperature sensor; occupancy sensor, and carbon dioxide sensor as indicated on the Mechanical Drawings.

F. The EMCS Contractor shall furnish to the terminal unit manufacturer the following components for factory installation and wiring for each terminal unit: VAV controller with integral differential pressure transducer and damper actuator.

G. The terminal unit manufacturer may provide the following components for each terminal unit for interface and mounting of the TUC: primary air dampers; enclosure to house the TUC and associated components including suitable mounting brackets shall be NEMA 1 rating and located outside the terminal unit; multi-point averaging type flow sensor at the primary air inlet to the terminal unit; 24 VAC control transformer; 24 VAC fan control relay interface; 24 VAC heater control relay interface (up to two stages); 24 volt SCR heater input as scheduled (0-10 Vdc or 4-20 mA).

H. Any items required for proper operation but not provided by TU vendor, shall be provided under this section.

2.8 AIR HANDLING UNIT CONTROLLER

A. All devices required for single loop control shall be terminated on a single controller. (for example, AHU static pressure control. The differential pressure sensor and the VFD ramp signal.)

B. The EMCS Contractor shall provide controllers required for chilled/hot water and DX/electric heat air handling units and fan coil units. Provide an enclosure to house the controller and associated components including suitable mounting brackets shall be NEMA 1 rated and located outside the FCUs.

C. The controller shall be capable of monitoring and controlling the following parameters per the sequences of operation and input/output summary; space temperature; space relative humidity sensor; cooling/heating stage control or modulating valve control; fan on/off control and status; supply air sensor; occupancy sensor; carbon dioxide sensor; VFD control and monitoring.

2.9 EMCS CONTROLLER LEVEL NETWORK

A. EMCS Automation Level Network shall consist of BACnet MS/TP (76.8 Kbps minimum). Data transfer rate and data throughput as required to meet the alarm annunciation requirements.

2.10 SOFTWARE OVERVIEW

A. Dynamic Colored Floor plans: Dynamic colored floor plans that compare actual space conditions to setpoints shall be provided on all floorplan graphics displayed on the front-end. Floorplan enlargements shall also use the thermographs to display space conditions. Zones within the set point range shall appear transparent white. As the space gets warmer the zone color shall gradually modulate from transparent white to transparent red to identify a hot zone. As the space conditions get cooler the zone color shall gradually modulate from transparent white to transparent blue to identify a cold zone. Each zone shall indicate the current actual zone temperature within the zone. The floor plans shall use a dynamic scheduling icon to indicate schedule occupancy for each zone and provide direct one-click access to that zones unique schedule. Provide a designated icon or symbol indicating that the zone is in the occupied/unoccupied condition. From the floorplan graphic, the operator shall be able to click on any zone and go directly to the graphic for the piece of equipment controlling that zone. All dynamic floor plans shall be visible via web interface as well as on the LAN. The authorized system operator shall be able to change the zone or system identifier (or name) on the graphic and that change shall be distributed to other associated graphics and to the equipment controller.

B. Pop up Trends: Provide trend logs that automatically pop up when the operator mouse clicks on the point from the graphic. Provide pop up trends for all dampers, control valves, temperature sensors, carbon dioxide sensors, humidity sensors, airflows, static pressures, flow meters, VFD speeds, etc. The EMCS contractor shall set up all trends for the owner. The pop-up trend shall include a trend tool that allows the operator to modify the trend time scale and sample interval for up to 10 sample values. The trends shall be graphical on the computer screen but shall provide an output as an .xls, .csv, .pdf, HTML, or text file.

C. Interactive Maps: Implement JAVA SCRIPT API 3.0 or newer, such as Google Interactive maps depicting the facility location to indicate the site plan. This is not a static image and must be completely interactive.

D. Custom User HTML applications: The EMCS shall utilize HTML applications as an extra feature. At minimum, provide 7-day forecast, weather radar, traffic map and hurricane tracker. All of these features shall be imbedded into the EMCS system.

E. Provided a web-based EMCS platform; contractor shall provide an Open License software. Licenses that are not open are not acceptable. There shall be no per seat or per user licensing fee charged to the owner by the contractor.

F. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms shall be BACnet Objects.

G. User access shall include 50 assigned operators that shall include five levels of access within the web system. Each operator log-in shall have an expiration date to allow for temporary access to the system. The operator's access description shall include his e-mail address and cell/phone numbers. The operator access can be limited from 5 minutes to permanent access. The user shall be limited to eight bad login attempts before being locked out of the system.

H. Global modification: Provide the capability for global modification of user definable parameters of all points shall be provided. Global modification is defined as the mass adjustment of user definable parameters across a defined group, area, facility, campus, or network. Parameters shall include, but not be limited to temperature set point (VAV boxes, AHU Discharge, VAV AHU Static Pressure Setpoints etc.), equipment start/stop, equipment status, valve output signal, VFD speed control signal, and damper position signal. User shall be able to lock the definable parameter to a set value, or adjust a set point to an operator adjustable value. This function shall be accomplished through the standard graphical user interface/workstation and is to be selectively applicable by the user to all controllers on the network, all controllers in a specific facility or all controllers in a specific zone within a specific facility.

I. The system operator shall be able to override the output signal to the valves, dampers, variable frequency drives, etc. with the use of the PC mouse click on the device. The system override shall include a Hand-Off-Auto (HOA) capability. If the output is commanded to the hand position the operator shall designate an output value of 0-100% in 1% increments. The hand override position shall be permanent or expire after a designated time period and revert to the auto position. The color-graphic shall indicate the device that has been overridden by a color change of the output value.

J. For non-emergency in-warranty events the system operator may submit a Service Request directly from the floor plan or system graphic. The web interface shall include the EMCS suppliers contact information including phone numbers and e-mail address. The service request will be logged into the EMCS suppliers service department. A non-response by the assigned technician shall elevate the request to the next highest manager or supervisor until the system operator receives an response that their request has been received and is scheduled for a resolution. All requests for service shall be maintained in the customer's database for future reference. The service request capability may be extended after the expiration of the warranty as part of a service agreement.

K. The web-based system shall be accessible from Tablet PCs and provide the same functionality that is available from personal computers connected through the LAN or WAN to the system operator. The tablet PCs as a minimum shall include an Apple iPad and Google Android based tablet PC. Operation shall include touch screen capability and use of the tablet keyboard screen. The operator shall be able to view color-graphics, system trends, override setpoints, change time schedules, and override damper and valve positions.

2.11 ENERGY SAVING PROGRAMS

A. Demand Limiting: Demand limiting programming and sequence shall include, but not be limited to the following:
   1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
   2. Integrate with lighting controls to reduce lighting power to an operator set maximum demand level.
   3. Provide a means from the graphical user interface for the system operator to manually initiate or disable the demand limiting sequence.
   4. Provide programming that will allow a demand response signal from an approved entity (electrical service provider) to remotely initiate or disable the demand limiting sequence.

5. Provide programming that will initiate demand limiting according to a schedule.
6. When demand limiting is initiated, the EMCS shall:
   a. Increase the space cooling temperature setpoint by 4 degrees F (adj), above the current operating setpoint. The rate of change for the temperature setpoint increase shall be operator adjustable.
   b. Decrease the space heating temperature setpoint by 4 degrees F (adj), below the current operating setpoint. The rate of change for the temperature setpoint decrease shall be operator adjustable.
   c. Automatically reduce lighting power on the circuits indicated on construction documents.
7. When demand limiting is disabled, the EMCS shall reset temperature setpoints and lighting power levels back to original operating setpoints.
8. Demand limiting shall be confined to “non-critical” zones. For purposes of planning, assume all zones are “non-critical” unless otherwise noted on the construction documents. All zones shall have the option to be added or removed from the demand limiting program, by the system operator.
9. The EMCS shall include a graphic "page" that shows all adjusted setpoints (original setpoints and demand limited setpoints) and the power meters being monitored to confirm the programming is operational and effective at shedding the associated loads.

B. Duty Cycling: Periodically stop and start loads, based on space temperature, and according to various on/off patterns.

C. Automatic Time Scheduling: Self-contained programs for automatic start/stop/scheduling of building loads. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary schedules.

D. Optimal Start/Stop: Perform optimized start/stop as function of outside conditions, inside conditions, or both. Optimization shall be adaptive and self-tuning, adjusting to changing conditions by modifying occupancy period based upon the desired temperature at beginning and end of the occupancy period. Base optimization on occupancy schedules, outside air temperature, seasonal requirements, and interior room temperature. Employ adaptive model prediction for how long building takes to warm up or cool down under different conditions.

E. Night-Setback Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours in conjunction with scheduled start/stop and optimum start/stop programs.

F. Setpoint Reset: Setpoints for control of variable load systems shall be reset based on load demand, as described in the Sequence of Operations.

G. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.

H. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.

I. Holiday Scheduling

J. Direct Digital Control: Furnish software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.

K. Trend logging shall be provided for all points per the input/output summary where there is a change in the analog or binary signal. Each controller shall be capable of storing trend values and then automatically transfer data to the NAC or the NS hard disk. Trend data shall be updated continuously per the operator assigned interval at intervals as low as one minute. Collect samples at intervals specified in minutes, hours, days, or month. Output trend logs as line-graphs or bar graphs. Binary points (input and output) shall only be logged upon a change of value (COV). Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.12 FIELD INSTRUMENTATION

A. Temperature Sensors: All temperature sensors shall be thermistor type, factory-calibrated to within 0.5 °F, interchangeable with housing appropriate for application. Sensors shall have a temperature curve rated for the application. Sensor wiring terminations shall be in a galvanized box.
   1. Outside air temperature sensors shall be installed in weather proof enclosure with ventilated sun-shied.
   2. Duct mounted temperature sensors shall be averaging type for supply air, mixed air and low temperature applications for air handling units. Duct probe temperature sensor shall be acceptable for terminal units.
   3. Thermowell temperature sensors shall be stainless steel probe of length that is equivalent to a minimum of 50% of the pipe diameter. End-to-end accuracy shall be ± 0.5 deg. F. Connection box shall be moisture/water proof with conduit fitting. Furnish the stainless steel thermowell to the mechanical contractor for installation. A thermal conducting grease shall be installed in the thermowell to provide uniform temperature sensing.
   4. Provide flat plate stainless steel space temperature sensors with no local setpoint adjustment as indicated on the drawings. Temperature sensors to be mounted 12-24 inches below the celing near the space return.

B. Carbon Dioxide Sensors: The sensor shall be capable of monitoring carbon dioxide concentration with an accuracy of +/- 30 parts per million (PPM). The sensor shall produce a linear 0-10 VDC or 4-20 mA signal over the range of 0 to 2000 PPM. The sensor shall measure using non-dispersed infrared (NDIR) technology to measure carbon dioxide gas and shall be:
   1. Wall mounted carbon dioxide sensors shall be Veris CWE series or equivalent.
   2. Duct mounted carbon dioxide sensor shall be Veris CWD series or equivalent.
   3. The EMCS contractor shall utilize the required calibration devices to properly commission and calibrate the sensors per the manufacturer’s requirements.

C. Relative Humidity Sensors: relative humidity sensors shall be a two-wire type, 4-20 mA output proportional to the relative humidity range of 0-100%. The accuracy of the sensors shall be +/- 2% over a range of 10-90% RH.
   1. Outdoor relative humidity sensors: provide non-corroding outdoor shield to minimize wind effects and solar heating. Install wall-mount weather proof enclosure with conduit fitting. Sensor shall be Veris HO series, or equivalent.
   2. Wall-mounted relative humidity sensor: sensor shall be installed in a wall-mounted enclosure with white cover. Sensor shall be Veris HEW series or equivalent.
   3. Duct-mounted relative humidity sensor: sensor shall be provided with a moisture resistant enclosure with conduit fitting. The probe length shall be 8” minimum. Sensor shall be Veris HED series or equivalent.

D. Pressure Transducers:
   1. Air pressure transducer: The pressure transducer shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. The accuracy shall be +/- 0.25% FS. Transducer shall be SETRA Model 264 or equivalent. Air pressure sensors and all associated tubing, hardware, and accessories shall be provided as appropriate for the application.
      a. Duct mounted pressure sensor shall be stainless steel and provided with mounting flange and hardware. The sensor probe length shall be appropriate for the associated duct dimensions.
      b. Wall mounted space pressure sensor shall include stainless steel wall plate, pressure pick up filter, and mounting hardware.
      c. Ceiling mounted space pressure sensor shall be paintable, low-profile type, with pressure pick up filter, integral surge dampener, and adhesive ring for ceiling mount.
      d. Outdoor pressure sensor shall include an outdoor rated sensor, 50 ft. of vinyl tubing, mounting bracket and hardware. A surge dampener shall also be provided for all outdoor pressure sensor applications to absorb pressure fluctuations.

2. Water pressure transducer: The pressure transducers shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. The accuracy shall be +/- 0.25% FS. Transducer shall be SETRA Model 230 or equivalent. Transducer shall be installed with a valved piping bypass and bleed off for each port. Water pressure sensors and all associated tubing, hardware, and accessories shall be provided as appropriate for the application.

E. Freezestat: Provide freezestats for all chilled water air handling systems that receive more than 10% untreated outside air. Freezestats shall provide vapor tension elements, which shall serpentine the inlet face on all coils. Provide additional sensors, wired in series, to provide one linear foot per square foot of coil surface area. Freezestat shall be manually reset at the switch. Interlock to the associated fan so that fan will shut down when HOA switch is in hand or auto position. Provide time delay relays with a 0-10 minute time delay relay duration to minimize nuisance freezestat trips. Time delay relay shall be adjustable at the associated control panel.

F. Air differential pressure switch: For fan shutdown, provide air differential pressure switches for all fans controlled by a variable frequency drive (VFD) to shut down the associated fan in the event of sensing high differential pressure. Air differential pressure switches shall have an adjustable setpoint with a range of 0-10 inches w.g. with manual reset at the switch unless otherwise indicated to be automatic reset. Provide ¼ inch copper tubing with compression fittings to mount to the side of the duct. Sensor shall be DWYER Series 1900 or equivalent.

G. Momentary control relays: Provide momentary control relays as indicated. Relays shall have coil ratings of 120 VAC, 50 mA or 10-30 VAC/VDC, 40 mA as suitable for the application. Contact ratings shall be 10 amp. Provide complete isolation between the control circuit and the digital output. Relays shall be located in the UC or other local enclosures and have pin-type terminals. Relays shall have LED indication of status.

H. Current sensing relay: Current sensing relays shall be rated for the applicable load. The output relay shall have an accessible trip adjustment over its complete operating range. Enclosure shall have an LED to indicate relay status.

2.13 HVAC VENTILATION SHUTDOWN SWITCH

A. The HVAC ventilation shutdown switch shall be a mushroom type switch, STI Series 2000 Stopper Station that complies with the following:
1. Color shall be coordinated with the Owner prior to ordering.
2. Latches when depressed.
3. Twist to reset.
4. Indoor/Outdoor flush type clear plastic cover.
5. Switch label shall read "HVAC VENTILATION SHUTDOWN" or other label approved by the Owner. Coordinate final label text with the Owner prior to ordering.

B. Coordinate final location of shutdown switch with the Mechanical Drawings, the Architect, and the Owner prior to installation.

2.14 WATER FLOW METERS

A. Insertion Electromagnetic Flow Meters shall be provided for HVAC metering and domestic water metering applications where indicated on mechanical drawings or in control diagrams in piping larger than 1 inch. The flow meter shall have a 316L stainless steel insertion probe with XAREC sensor head and weather-tight NEMA 4 electronics enclosure; +/- 1.0 % accuracy of actual reading from 2 to 20 ft/s and +/- 0.02 ft/s below 2 ft/s; flow range of 0.1 ft/s to 20 ft/s, turndown ratio of 200:1; pulse outputs proportional to flow rate. All wetted materials used in domestic water metering applications shall be NSF 61 and 372 compliant. The flow meter shall be installed with a minimum of 10 diameters of straight pipe upstream and 5 diameters of straight pipe downstream. Refer to meter manufacturer's installation manual for additional straight pipe length requirements. Provide full port valve to allow for removal and re-insertion without disruption to the water service. Meters provided for HVAC applications shall be furnished and installed by Division 23. Meters provided for Domestic water applications shall be furnished by Division 23 and installed by Division 22. Meter shall be ONICON F-3500 series or pre-approved substitution. Domestic water flow meters shall be approved by the associated Municipal Utility District (MUD).

B. Inline Wetted Ultrasonic Flow Meters shall be provided for cooling tower make-up water metering and blow down metering applications in piping ranging from ½" to 2 ½". The flow meter shall consist of a drop forged corrosion resistant metal flow body with process connections, integral transducers, transmitter with LCD display and user interface. All wetted materials shall be NSF 372 compliant; +/- 1.0 % accuracy of actual reading over a 25:1 turndown ratio; overall flow range turndown of 500:1; pulse and analog outputs proportional to flow rate and native BACnet MS/TP. Contractor shall provide a y-strainer upstream of each meter and isolation valves upstream and downstream of each meter. Placement of the flow meter must meet or exceed the manufacturer's published placement requirements. Meters shall be furnished and installed by Division 23. Meter shall be ONICON F-4600 or pre-approved substitution. Cooling tower meters shall be approved by the associated Municipal Utility District (MUD).

2.15 AIRFLOW MEASURING STATIONS (AFMS)

A. Duct mounted airflow measuring stations with combination airflow and air temperature measurement devices shall have the following features:
1. Multi-point sensors in one or more probe assemblies with a maximum of one to sixteen sensor nodes per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Each independent temperature sensor shall have a calibrated accuracy of +/-0.15° F (0.08° C) over the entire operating temperature range of -20° F to 160° F (-28.9° C to 71° C) and shall be calibrated at 3 temperatures against standards that are traceable to NIST. Acceptable manufacturer shall be EBTRON, Inc. GTx116-PC.
2. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.
3. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of Reading over the entire calibrated airflow range of 0 to 5,000 fpm (25.4 m/s) and shall be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

2.16 DAMPERS

A. Provide motorized volume control and shutoff dampers as detailed in 23 33 00 - Ductwork Accessories.

2.17 DAMPER ACTUATORS

A. Outside and exhaust air damper actuators shall be mechanical spring return. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.

B. Outside and return air modulating actuators shall utilize analog (proportional) control 0-10 VDC. Actuators shall be driven in both the open and closed directions.

C. Electric damper actuators shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.

D. Single section dampers shall have one electronic actuator direct shaft mounted.

E. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section.

F. Damper actuators shall be BELIMO or equivalent.

2.18 CONTROL VALVES

A. Furnish all valves controlled by the EMCS as shown on the Mechanical Drawings. Furnish all automated isolation valves as shown on the Mechanical Drawings. Control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. EMCS contractor to size control valve with a maximum of 3 psi pressure drop. 2-position isolation valves shall be full-line size.
   1. All chilled water, condenser water, and hot water valves shall meet, at minimum, the following ANSI Class 150 ratings. Valves 0.5 inch to 2 inches shall have NPT female screwed ends. Valves 2.5 inches and larger shall have flanged ends.
   2. Equal Percentage control characteristic shall be provided for all water coil control valves.

B. Pressure Independent Characterized Control Ball Valves ½" to 6", for two-way modulating applications shall have equal percentage characteristics and control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI across the valve. The pressure independent control valve shall be provided and delivered from a single manufacturer as a complete assembly. The actuator shall be integrally mounted to the valve at the factory with a single screw on a direct coupled DIN mounting-base. All valve actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow and/or temperature control. Programming using actuator mounted switches or multi-turn actuators are not acceptable. The control valves shall be sized for the scheduled flow and not pressure drop. Calibrated Balancing Valves and Automatic Flow-Control Valves shall be prohibited from use at coil circuit piping where pressure independent control valves are installed. Contractor shall provide a section of straight pipe five times the pipe diameter with respect to the nominal valve size upstream of the control valve assembly where utilizing integral flow sensor to guarantee sensor accuracy.
   1. NPS 3/4" and Smaller: Belimo PIQCV or equal. Forged brass body rated at no less than 360 PSI, stainless steel ball and blowout-proof stem, characterizing disc integral to ball, PTFE ball seat, dual EPDM lubricated O-rings, and female NPT union ends. Close off pressure rating of 100 psi. Integral pressure regulator located upstream of ball to maintain a constant pressure differential. Replaceable cartridge type regulators are not permitted.
   2. NPS 1" through 2": Belimo ePIV or equal. Forged brass, nickel-plated body rated at no less than 360 PSI, stainless steel ball and blowout-proof stem, PTFE ball seat, dual EPDM lubricated O-rings, stainless steel or TEFZEL characterizing disc, and female NPT union ends. Close off pressure rating of 200 psi. Valve shall be integrated with an electronic (ultra-sonic or electromagnetic) flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psi.
   3. NPS 2-1/2" through 6": Belimo ePIV or equal. GG25 cast iron body according to ANSI 125, Class B, stainless steel ball and blowout-proof stem, PTFE ball seat, with a dual EPDM lubricated O-rings and a stainless steel flow characterizing disc. End connection pattern to match ANSI 125 flange. Close off pressure rating of 100 psi. Valve shall be integrated with an electronic (ultra-sonic or electromagnetic) flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psi.

C. Characterized Control Ball Valves (CCV) for ½' to 2": for 3-way modulating applications shall have equal percentage characteristics. Manufacturer shall be Belimo or approved equal.
   1. Valve housing shall consist of forged brass rated at no less than 400 psi at 250 °F. Three-way valves shall have EPDM O-rings behind ball seals to allow for a minimum close-off pressure of 40 psi with an actuator that provides 35 in-lbs torque for ½ to 2 in. sizes. Three-way valves shall be installed in a "tee" configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.

D. Globe Valves 2-1/2" to 6": for 3-way modulating applications shall have equal percentage characteristics. Manufacturer shall be Belimo G7 series or approved equal.
   1. Valve housing shall consist of cast iron rated at no less than 125 psi at 300 °F. Valve shall have stainless steel stem, plug and seat. Three-way valves shall be installed in a "tee" configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.

E. Butterfly valves: For chiller and cooling tower isolation control valves, butterfly control valves may be provided.

1. Butterfly Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats. Butterfly valves shall have ductile iron body, 304 stainless steel disc and EPDM seat. The valve body close-off pressure rating shall be 150 psi over a range of -20 F to 250 F. The flange shall be ANSI 125/250. Belimo F6 and F7 series or approved manufacturer.

F. Actuators for characterized control valves and globe valves: Provide electric actuators for all control valves that are furnished as part of the EMCS contract. Two-way and three- way control valve actuators shall meet, at minimum, the following requirements:
1. Motor driven type with gear assembly made of hardened steel. Actuator shall have an input voltage of 24 VAC. Provide visual mechanical position indication.
2. Actuators installed within the interior of the building envelope shall be provided with NEMA-2 rated housings.
3. Actuators installed exterior to the building envelope shall be provided with NEMA-4 rated housings or a weather shield. All penetrations through exterior actuator housings shall be provided with fittings that prevent water ingress.
4. Valves shall be sized to meet the shut-off requirements when operating at the maximum system differential pressure and with the installed system pump operating at shut-off head. Actuators shall control against system maximum working pressures.
5. Normal and failure positions shall be as indicated in the operating sequences. Provide spring return action per the sequences.
6. Manual declutch lever to enable manual operation of the valve. It shall be possible for an operator to manually modulate valves located in mechanical rooms in the event of loss of power.
7. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.
8. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.
9. Electric actuators shall be Belimo, compatible with the valves furnished.

G. Butterfly Valve Industrial Actuators
1. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.
2. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1 phase, 60 Hz supply. Two adjustable cam actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.
3. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.
4. Actuator shall have a 6 ft wiring harness provided for ease in field wiring (above 1500 in-lbs). Two adjustable SPDT cam-actuated auxiliary switches, rated at 250 VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.
5. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.
6. The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All analog valves shall be positive positioning, and respond to a 2-10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.
7. Butterfly valve actuators shall be Belimo furnished with specified butterfly valves.

2.19 REFRIGERANT LEAK DETECTION

A. Refrigerant leak detection monitors shall be provided for the refrigerant and number of chillers installed.
1. Power consumption: AC - 325 mA, DC - 250 mA. Volt free contacts to indicate an alarm condition.
2. Operating temperature range of 32 °F to 105 °F. Operating humidity range of 0 to 95% non-condensing.

3. Measuring range of 0-1000 ppm proportional to 4 to 20mA output range for each sampling point.
4. System shall detect the presence of the types of refrigerants provided with the chillers using sequential sampling and multi-point monitoring method.
5. System shall annunciate to the EMCS through a contact closure and have a local alarm (audible and visual) Control panel shall have a silencing alarm button. Initial alarm shall comply with recommended Allowable Exposure Level (AEL). Adjustable 3 level alarm for each point shall be supplied with common alarm output contacts. Provide local digital indication of ppm level for a minimum of 1 sample point per chiller. A sample point shall be located close to each chiller and the refrigerant pump out unit location. Location to be approved by the engineer. Sample point if in alarm shall flash the associated LED. Provide local alarm horns and visual (stroboscopic) beacons at the following locations to activate upon alarm to an approved detail:
   a. Outside of entrance doors to chiller machine room.
   b. Inside rooms without an escape route other than through the chiller room.
   c. At each chiller location.
   d. At any other location in the chiller room as necessary to ensure that a person at any location in the chiller room and room that can be entered from the chiller room can see the visual alarm and hear the audible alarm and at any other location required to meet the applicable codes.
6. Emergency signs shall be provided in accordance with NFPA 704. Signs shall include a warning that the visual and audible alarms indicate a refrigerant leak has been detected and the monitored area should be evacuated. Sign material shall be engraved, laminated, UV resistant plastic or etched metal with self-adhesive backing. Submittals shall include sign material, dimensions, color, lettering format, and warning message for approval. Emergency signs shall be installed outside each exit door to monitored rooms. Install signs near alarms located at exits where they can be easily seen. Coordinate final locations with the Architect and Owner prior to installation.
7. System shall shut down all electrical equipment (chiller systems and associated pumps, AHU, FCU, etc.) and sequence emergency extract equipment as required to meet regulations. Where combustion equipment is employed, refrigerant vapor monitoring system shall automatically shut down the combustion process in event of refrigerant leakage if other alternative acceptable conditions are not applied. Ventilation system, chiller and associated pumps and other equipment shut down as a result of the refrigerant leak alarm shall return to normal operation when the refrigerant monitoring system is no longer detecting refrigerant levels above set points and alarms have been silenced.
8. System shall have self-diagnostics and supply common malfunction output. Loss of sample flow at either sample or ZERO line and electrical malfunction shall annunciate to the EMCS.
9. Provide two (2) additional particulate filters and zero gas filter cartridges.
10. Provide an emergency shut-off control button outside each chiller plant room entrance/exit door. Button shall be mounted at 48 inches above finished floor adjacent to refrigerant leak detection alarm light. Activation of any one of the buttons shall de-energize all chillers and other electrical equipment within the chiller plant room. Button shall be manually reset.
11. Provide BACnet MS/TP interface to EMCS. Provide Strobe/Horns and Emergency Push Buttons.
12. Maximum System Maintenance Requirements - The system shall require no periodic maintenance other than periodic checking. Periodic checking or adjustments of the unit shall be capable of being accomplished by one person at the unit location.
13. Manufacturer Capability Requirements - As a minimum, the Gas Monitoring Equipment manufacturer must meet the following requirements:
    a. Be capable of supplying all equipment used to check or calibrate the unit
    b. Be capable of providing onsite service with factory trained personnel
    c. Be capable of providing start-up assistance and training for the owner/operator
14. Gas Monitoring System shall be a Mine Safety Appliances Company Chillgard RT Refrigerant Monitor or equal.

2.20 PANELS AND ENCLOSURES

A. Provide panels and enclosures for all components of the EMCS, which are susceptible to physical or environmental damage.

B. Interior panels and enclosures shall meet be NEMA 1 rated painted steel panels with locking door.

C. Exterior mounted panels and enclosures shall be NEMA 4 painted steel panels with locking door.

D. Panels for USCs shall be mounted on the outside of all unit ventilators and fan coil units with three feet of wall clearance in front of them and no higher than 7 feet to the bottom of the panel.

2.21 LABELING AND WARNING NOTICES

A. Provide labeling for all control panels and enclosures.

B. Provide labeling of all control wires and input/output points at the controller and at the control device; the label at each end of the wire shall be the same Labels shall be machine generated, typed and clearly legible with a maximum of 17 characters. Hand written labels or labels written on the control wire jacket will not be acceptable. Each label shall be unique to its function and shall reference the applicable system. For example “AHU-1 SAT” will indicate the supply air temperature sensor for AHU-1. Improper labeling shall be removed and shall require re-commissioning of the control device and controller to document correct functionality.

C. Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.

2.22 TUBING AND PIPING

A. Provide tubing and piping as required for the field instrumentation.

B. Tubing within equipment rooms, vertical risers, and penetrations to ductwork shall be either copper pipe or shall be plastic tubing within conduit. Tubing for all water-based instrumentation shall be copper pipe. Identify the type of tubing proposed in the shop drawing submittal.

C. Provide suitable bulk head fittings for duct and panel penetrations.

D. Tubing in plenum rated areas may be plastic tubing. Polyethylene tubing shall meet, at minimum, the following requirements: flame retardant; crack resistant; 300 psi burst pressure.

2.23 CONDUIT AND FITTINGS

A. Provide all conduits, raceways and fittings for the EMCS monitoring, communication and control cabling. All work shall meet all applicable codes.

B. Conduit, where required, shall meet, the requirements specified within Division 26.

C. EMCS monitoring and control cable shall not share conduit with cable carrying voltages in excess of 90 VAC.

2.24 CABLING

A. Provide all cables for the EMCS. Cable shall meet, at minimum, the following requirements:
1. Minimum 98% conductivity stranded copper.
2. Proper impedance for the application as recommended by the EMCS component manufacturer.
3. Monitoring and control cable shall be #18 AWG or larger, dependent on the application. Analog input and output cabling shall be shielded.
4. Management Level Network cable shall be CAT 6, 24 gauge unshielded.
5. Automation Level Network cable shall be #24 AWG shielded.
6. Shield shall be grounded at the CCP, UC, or control panel. Ground at one end only to avoid ground loops.
7. Identification of each end at the termination point. Identification should be indicated on and correspond to the record drawings.

B. 120 VAC power wiring shall be of #12 AWG solid conductor or larger as required.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION

A. The EMCS supplier shall provide a pre-construction coordination meeting with the affected trades to ensure a cooperative efficient process of installation. The invited trades shall include the general contractor, mechanical contractor, electrical contractor, test and balance contractor, commissioning provider, owner's representative, consulting engineer and others with a direct interest in the coordination of the affected systems. The EMCS contractor shall provide an outline of the meeting agenda highlighting the construction schedule, coordination with mechanical and electrical trades. Provide a sign-in sheet and submit it through the attendees along with a summary of the meeting notes for future reference.

3.2 INSPECTION DURING INSTALLATION

A. Provide a technician to assist the Engineer or Owner's Representative with inspections made during the installation period that are required to review the progress and quality of ongoing work. The engineer/owner's representative shall generate field observation reports on the findings of the inspection. The engineer or owner's representative shall advise the EMCS contractor during the inspection of any concerns noted with respect to the installation and shall repeat the concerns in writing as soon as possible after the inspection is completed. The EMCS contractor shall take corrective action to meet the requirements of the specifications. Upon correction, the EMCS contractor shall submit written documentation through the contractors to the engineer.

3.3 INSTALLATION OF COMPONENTS

A. Provide all interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with specification Division 26 and all national, state and local electrical codes.

B. Provide wire and wiring techniques recommended by equipment manufacturers. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in. Provide auxiliary pilot duty relays on motor starters as required for control function.

C. Electrical Contractor shall provide 120 or 277 volt power at a junction box within 48" of the controller. The BAS Contractor shall coordinate with the Electrical Contractor to identify locations of power requirements prior to the installation of the controls.

D. Conduit for control wiring shall be provided whenever one of the following conditions exists:
1. Conduit is indicated on the drawings or specifically required by the specifications.
2. Cabling runs through inaccessible areas such as within partitions/walls, above closed in ceilings, under floor; within trenches and underground; on the exterior of the building; exposed on the surface of the building; when encased in concrete or other material that makes the cable inaccessible or when located such that access to the cable is not readily obtained.
3. Cable within mechanical, telecommunications and electrical equipment rooms and control rooms.
4. Conduit shall be installed, inside wall from sensor box to above the wall, for all wall mounted temperature, humidity and CO2 sensors.

E. Control wiring located above an accessible ceiling space may be plenum rated cable. Plenum rated wire shall be bundled and routed at right angles to the building lines and secured to the building structure every 15 feet.

F. Control wiring located in underground conduits shall be provided with direct-burial-rated insulation.

G. When communication bus enters or exits a building, a surge suppressor shall be installed. The surge suppressor shall be installed according to the controls manufacturer's instructions.

H. Provide sleeves for all cable and conduit passing through walls, partitions, structural components, floors and roof.

I. All sensor wiring shall be labeled to indicate the origination (at the device) and destination of data (at the control panel). The description shall indicate the type and location of the control device such as “AHU-1 SA temp” or “VAV 1-1 space temp”.

J. Wall temp sensors at 48” above the finished floor to comply with ADA requirements and to match the height of the light switches. Mount humidity sensor at equal height to wall temperature sensor.

K. Outdoor pressure sensors shall be installed a minimum of five feet above the roof surface and shall be free of immediate obstructions and sources of turbulence that could affect pressure readings. Sensors shall be attached to the top of roof mounted equipment or provided with stand-alone vertical support if no roof mounted equipment is available. Sensor tubing shall be routed into the building through a sealed weathertight penetration. Provide a heat trap loop in the sensor tubing immediately below the roof.

3.4 VERIFICATION REQUIREMENTS

A. Verification shall be provided by the EMCS contractor to demonstrate and confirm that the installed system complies with the specifications and the control sequences of operation herein specified. upon completion of the verification process the EMCS contractor shall demonstrate to the engineer or owner’s representative the functionality of the control system devices are in compliance with the contract documents.

B. Technicians provided by the EMCS contractor shall be factory trained and qualified in the operation of the provided control system. The EMCS contractor shall provide, if requested, the factory training certificates of the individuals providing the verification services on this project.

C. Verification tools, applicable to the system provided, shall be utilized by the factory-trained technicians for proper verification of system operation and functionality. Temperature verification sensors shall be NIST certified within the last 12 months. Meters such as Fluke 52 series or better shall be utilized. Use of non-certified meters may require the system to be re-verified with certified meters at no cost to the owner.

D. Documentation of the verification process shall be provided per the project general conditions in electronic PDF format as required. Documentation shall include the following forms:
1. Project System Verification Forms for each controller provided on the project to verify the proper function of each controller, control device and system component provided.
2. Panel Verification Forms for each control panel to document the proper installation and function of each control panel provided.
3. Sequence of Operation Verification Forms for each piece of controlled equipment to confirm compliance of the control system with the specified sequences of operation.
4. Not providing proper documentation for each control devices, panel, or system, upon request by the engineer or owner’s representative, may require the EMCS contractor to re-verify the applicable systems at no additional cost to the owner.

E. After completion of the verification, the EMCS contractor shall be able to demonstrate the sequence of operations for each system to the engineer and the owner’s representative.

F. Equipment checkout sheets are to be produced by this contractor showing checkboxes and compliance with the following procedures for each piece of equipment and turned over to the owner and/or mechanical engineer.

3.5 COLORGRAPHICS

A. The colorgraphics shall be provided for the EMCS system prior to system acceptance and owner training.

B. The colorgraphics provided shall include the following as a template. Provide forward and backward links on the graphic.
1. Site plan with link to overall building plan including detached buildings. The site plan shall be referenced to an automatically updated aerial view or map view of the area such as Google Maps or Bing Maps. Provide link to proceed to the overall building floor plan.

2. The overall building plan shall indicate space temperature conditions referenced by the color of the zone. Specific details of the zone temperatures and equipment are not required. Provide a link to the floor plan wings, upper floors and remote buildings.
3. The floor plan colorgraphics shall indicate the space temperatures by color references. Additional information shall indicate the space temperature, the occupancy of the zone, air handling units, VAV terminals and ductwork with diffusers. A link at each terminal unit or AHU shall automatically connect the system operator to the equipment colorgraphic.
4. The colorgraphics for the equipment shall as a minimum be equal to the points from the input/output summary or control schematic. Primary control devices as required by the sequences of operation shall also be provided.
5. Control points from equipment that are integrated into the EMCS via BACnet shall be provided to convey the operating conditions of the attached equipment. Coordination of the integration points shall be accomplished during the submittal phase. The EMCS contractor shall provide a list of all integrated points on their submittal.

3.6 ENERGY MONITORING PROGRAMMING AND GRAPHICS

A. The EMCS shall be programmed to include a dedicated graphics page for energy monitoring.

B. The kW and kWH data acquired from each power meter shall be categorized within the EMCS by the following end-uses.
1. Total HVAC system loads
2. Interior lighting loads
3. Exterior lighting loads
4. Plug loads
5. Process loads
6. Building operations and other miscellaneous loads

C. The EMCS shall provide a graphic representation to show instantaneous real-time energy consumption data and shall provide hourly, daily, monthly, and yearly energy consumption data. Where multiple meters are used to measure an end-use category, the graphic representation for that end-use category shall include data from the individual meters as well as a total for the associated category. The graphic representation shall also include time and date of the highest peak demand for the current month and year as well as prior months and years for stored data. Demand thresholds may be set to adjust and shed loads in order to reduce peak consumption.

D. All meter data collected shall be stored for a minimum of 36 months and shall have the ability to be trended by building operation and management personnel on an hourly, daily, monthly, and yearly basis using the previous 36 months of stored data.

3.7 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Startup testing documentation: Prepare the checklist documenting startup testing of each input and output device, with technician's initials and date certifying each device has been tested and calibrated prior to acceptance testing. This document shall indicate proof that the following functions have been commissioned and shall be included in the as-built documentation: short to ground check, configuration of trends, confirmation that color-graphics are accurately representing actual systems, point to point checkout, all damper and valve actuators respond to input change, control modules are addressed and have functional descriptors, specified interlocks are functional, calibration report of all sensors, discrete outputs respond to time schedule or manual enable command.

B. Demonstration. Prior to acceptance, demonstrate the following performance tests to demonstrate system operation and compliance with specifications.
1. Engineer, owner’s representative and mechanical contractor shall be invited to observe and review system demonstration. Provide attendees at least 10 days notice.
2. Demonstration shall follow process approved as part of the submittal and shall include complete checklists and forms for each system as part of system demonstration.
3. Demonstrate actual field operation of each sequence of operation as specified. Demonstrate calibration and response of any input and output points requested by engineer or owner’s representative.

4. Demonstrate complete operation of operator interface including review of color-graphics, time schedules, trend logs, alarm notification, functionality of tablet PC operation.
   a. PID loop response. Supply graphical trend data output showing each PID loop's response to a set point change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be selectable from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show set point, actuator position, and controlled variable values.
   b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand limiting setpoint, and status of set points and other affected equipment parameters.
   c. Trend logs for each system. Trend data shall indicate set points, operating points, valve positions, and other data as specified. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs.
5. Alarms and Interlocks. Check each alarm with an appropriate signal at a value that will trip the alarm. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction. Alarm verification shall include temperatures exceeding alarm threshold (high and low), fan failure safety, duct high static pressure switch, freezestat, and smoke detector shutdown.
6. Tests that fail to demonstrate proper system operation to the engineer shall be repeated after contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

C. Owner Acceptance.
1. After tests described in this specification are performed to the satisfaction of both engineer and owner’s representative, the engineer shall accept the control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond EMCS contractor's control. Engineer shall provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved by the engineer.

3.8 DEMONSTRATION AND OWNER TRAINING

A. Furnish basic operator training for multiple persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 16 hours: 8 hours instructor time for onsite training and 8 hours of hands on class environment training. Training sessions may be provided in 4-hour increments as approved by the owner’s representative.
1. Change/modify temperature setpoints.
2. Change/modify time of day, holiday and override schedules.
3. Display, create, and modify trends of system points.
4. Update room numbers on the color-graphics.

B. Demonstrate complete and operating system to Owner. Provide written documentation listing the attendees of the specified training with sign-in sheet and training time and date.

3.9 SEQUENCE OF OPERATIONS

A. Refer to the Mechanical Drawings for project control schematics and sequence of operations.

END OF SECTION

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SECTION 23 21 13

ABOVE GROUND HYDRONIC PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe and pipe fittings.

B. Flanges, unions, dielectric connections, and couplings.

C. Valves.

D. Heating water piping system.

E. Chilled water piping system.

F. Condenser water piping system.

G. Condensate drain piping.

1.3 RELATED WORK

A. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping

B. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 05 53 - Identification for HVAC Piping and Equipment

E. Section 23 07 19 - HVAC Piping Insulation

F. Section 23 21 16 - Underground Hydronic Piping

G. Section 23 21 19 - Hydronic Specialties

1.4 REFERENCES

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.

E. ASME B31.1 - Power Piping; 2024.

F. ASME B31.3 - Process Piping; 2022, with Errata (2023).

G. ASME B31.9 - Building Services Piping; 2020.

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

I. ASSE 1079 - Performance Requirements for Dielectric Pipe Unions; 2012.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

K. ASTM B32 - Standard Specification for Solder Metal; 2020.

L. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

N. ASTM D1384 - Standard Test Method for Corrosion Test for Engine Coolants in Glassware; 2005.

O. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

P. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

R. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

S. ANSI/AWWA C110 - Ductile-Iron and Gray-Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

T. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

U. ASTM B32 - Solder Metal.

V. ASTM B88 - Seamless Copper Water Tube.

1.5 QUALITY ASSURANCE

A. Foreign made pipes and fittings will not be acceptable.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder’s Certification: In accordance with ASME BPVC-IX.

1.6 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include data on pipe materials, pipe fittings, valves, and accessories.

C. Include welder’s certification of compliance with ASME BPVC-IX.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division One.

B. Store and protect products under provisions of Division One.

C. Deliver and store valves in shipping containers with labeling in place.

D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping systems from entry of foreign materials by temporary covers, proper storage and dunnage, completing sections of the work, and isolating parts of completed system. Tape will not be allowed as an acceptable end cover.

PART 2 - PRODUCTS

2.1 CHILLED AND HEATING WATER AND GLYCOL PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black.
1. Fittings: ASME B16.3, malleable iron or ASTM A234/A234M, forged steel welding type fittings.
2. Joints: Threaded, or AWS D1.1/D1.1M, welded.

2.2 CONDENSER WATER PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40, 0.375 inch wall for sizes 12 inch and over, black. Black steel inside and glavanizes steel on the outside.
1. Fittings: ASME B16.3, black malleable iron or ASTM A234/A234M, galvanized forged steel welding type.
2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized.
1. Fittings: Galvanized cast iron, or ASME B16.3 malleable iron.
2. Joints: Threaded, or grooved mechanical couplings.

B. Copper Drainage Tubing: ASTM B306, DWV.
1. Fittings: ASME B16.23 cast copper alloy solder joint DWV fittings or ASME B16.29 wrought copper alloy solder joint DWV fittings.
2. Joints: Soldered joints made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn50/Pb50 solder.

2.4 FLANGES, UNIONS, DIELECTRIC CONNECTIONS, AND COUPLINGS

A. Pipe Size 2 Inches and Under: Provide 150 psi malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2 Inches: Provide 150 psi forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; 1/16 inch thick preformed neoprene bonded gasket.

C. Dielectric connections for pipe sizes 2 inches and under: Provide dielectric unions, rated at 180°F at 250 psi in compliance with ASSE 1079.

D. Dielectric connections for pipe sizes larger than 2 inches: Provide dielectric flanged pipe fittings, rated to 180°F at 175 psi in compliance with ASME B16.1.

E. Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer, and conform to local code approval and/or is listed by ASME B31.1, ASME B31.3, ASME B31.9, ASME, UL/ULC. FM, IAPMO or BOCA. Grooved end manufacturer to be ISO 9001 certified. Grooved couplings shall meet the requirements of ASTM F1476. Manufacturer shall be Victaulic, Anvil Gruvlok, or Shurjoint. Can be utilized only in mechanical rooms or cooling tower areas.

2.5 ACCEPTABLE MANUFACTURERS - VALVES

A. Milwaukee

B. Crane

C. Nibco

D. Apollo

E. Bray

F. Kitz

2.6 ACCEPTABLE MANUFACTURERS - VALVES (GROOVED ONLY)

A. Victaulic

B. Anvil Gruvlok

C. Shurjoint

2.7 GATE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, threaded ends.

B. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.8 GLOBE VALVES

A. Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable stainless steel disc, threaded ends, with back seating capacity.

B. Over 2 Inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.9 BALL VALVES

A. Up to 2 Inches: Bronze two-piece body, 600 PSI full port, stainless steel ball and stem, teflon seats and stuffing box ring, lever handle, and balancing stops, threaded ends.

B. Over 2 Inches: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, or gear drive hand wheel for sizes 10 inches (250 mm) and over, flanged.

C. Ball valves installed in insulated lines shall have stem extensions compatible with up to 2” of insulation. Extensions shall be non-metallic equal to Nibco “nib-seal”.

2.10 PLUG COCKS

A. Up to 2 Inches: Bronze body, bronze tapered plug, non-lubricated, teflon packing, threaded ends, with one wrench operator for every ten plug cocks.

B. Over 2 Inches: Cast iron body and plug, pressure lubricated, teflon packing, flanged ends, with wrench operator with set screw.

2.11 BUTTERFLY VALVES

A. Iron body, aluminum bronze or stainless steel disc, resilient replaceable seat for service to 180 degrees F lug or grooved ends, extended neck, infinite position lever handle with memory stop. Valve shall be rated at full working pressure with downstream flange removed in either direction.

2.12 SWING CHECK VALVES

A. Up to 2 Inches: Bronze 45 degree swing disc, threaded ends.

B. Over 2 Inches Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged or grooved ends.

2.13 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, stainless steel spring, aluminum bronze disc, threaded, grooved, wafer or flanged ends.

2.14 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. After completion, fill, clean, and treat systems.

E. Provide extended necks for all vents, thermometer wells, pressure gauge wells, pet cocks and pete’s plugs.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space and other work.

C. Group piping whenever practical at common elevations.

D. Branch tap connections to piping mains shall be from the top of the pipe.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.

F. Provide clearance for installation of insulation, and access to valves and fittings.

G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 09.

K. Install valves with stems upright or horizontal, not inverted.

L. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer.

M. Grooved manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and the product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

3.3 APPLICATION

A. Use grooved mechanical couplings and fasteners only in mechanical rooms or cooling tower area.

B. Install unions downstream of valves, and at equipment or apparatus connections.

C. Provide non-conducting dielectric connections wherever joining dissimilar metals.

D. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

E. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Install plug valves for throttling, bypass, or manual flow control services.

G. Provide spring loaded check valves on discharge of condenser and chilled water pumps.

H. Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

I. Use only butterfly valves in condenser water systems for throttling and isolation service.

J. Use lug end butterfly valves to isolate equipment.

K. Provide chain operated butterfly valve for installations at 12 feet or higher.

L. Provide 3/4-inch ball (drain) valves equal to Nibco T-585-70-HC at main shut-off valves, low points of piping, bases of vertical risers, and at equipment and pipe to nearest drain.

M. Provide automatic air vents at all high points and air pockets in the system.

3.4 CONDENSATE DRAIN PIPING

A. Drain piping from each unit shall be extended to the nearest floor drain or condensate drainage system. Drains shall be of the size indicated but not less than the full size of the drain pan connections.

B. Use plugged tees in lieu of elbows.

C. Slope all drain lines 1/8" per foot, minimum.

D. Provide auxiliary drain pan on all AHU's above ceiling with auxiliary drain line routed to discharge in visually prominent area. Discharge location shall be coordinated with Architect.

3.5 PIPE FABRICATION AND INSTALLATION

A. All pipes shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing.

B. Piping layout and installation shall be made in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance from other work. Particular attention shall be given to piping in the vicinity of equipment; layout shall be made in such manner as to preserve maximum access to the various equipment parts for maintenance.

C. All changes in directions shall be made with fittings; field bending and mitering of pipe is prohibited.

D. Air vents and air chambers shall be installed as hereinafter specified.

3.6 OFFSETS AND FITTINGS

A. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, etc. which may be required. The Contractor shall carefully investigate structural and finish conditions affecting the Work, and shall take such steps as may be required to meet such conditions at no additional cost to the Owner.

B. All piping shall be installed close to walls, ceilings and columns, (consistent with the proper space for covering, removal of pipe and special clearances), so as to occupy the minimum of space, and all offsets, fittings, etc., required shall be provided at no additional cost to the Owner.

3.7 SECURING AND SUPPORTING

A. All piping shall be adequately supported to line and grade, with due provisions for expansion and contraction.

B. Piping shall be supported on approved clevis type, split ring, or trapeze type hangers properly connected to the structural members of the building.

C. All insulated piping shall be fitted with suitable steel protection saddles.

D. Perforated bar hangers, straps, wire or chains will not be permitted.

3.8 ISOLATION VALVES

A. All piping systems shall be provided with line size shut-off valves located at risers, at branch connections to mains, and at other locations as indicated and required.

3.9 TESTING OF PIPING SYSTEMS

A. During the progress of the Work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Engineer. The Engineer or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this Work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems, testing shall be accomplished prior to the application of any insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours at a pressure of 150 psi(g) or 150% of design pressure, whichever is greater. Tests shall be witnessed by the Engineer or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks, damage, or defects.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

3.10 PIPE CLEANING, FLUSHING AND PURGING REQUIREMENTS AND PROCEDURES

A. The hydronic system shall be flushed and purged by contractor:
1. All mains, branches and zones shall be cleaned and treated per steps indicated below.
2. Owner/Engineer shall be given 72-hour notice prior to each step being performed.

B. Pre-flush requirements: Purpose is to get system ready for flushing and purging:
1. Piping must pass all required pressure testing and visual inspection for leaks.
2. All pumps shall be tested for rotation and properly aligned and lubricated.
3. Chemicals planning on being used must have certificate of assurance and product cut sheets presented to the owner/engineer prior to being used. All chemicals must be approved by the state prior to being added to the system, FDA approved and meet ASTM D1384. Automotive grade chemicals are not allowed.
4. Bypass all coils and heat exchangers by connecting the supply and return piping together.
5. Fill entire system with clean fresh potable water.

C. The flush requirements: Purpose is to completely remove all debris, dirt and air from hydronic system.
1. Add system cleaner that contains detergent and emulsifying agents to properly remove grease, grime and other debris for steel pipe. Volume of cleaner used shall be about 10% of total volume.
2. System shall be circulated for a minimum of 48 hours with water velocities of a minimum of 5 ft/sec or greater. After completed all strainers shall be removed and cleaned thoroughly. House pumps are acceptable to circulate water. House pumps or pump seals that are damaged during the flushing process shall be replaced at no cost to the Owner.
3. The system shall be entirely drained and flushed out to remove all of the cleaner from the system as quickly as possible after cleaning to prevent debris from settling. All strainers shall be removed and thoroughly cleaned after no more dirt and cleaner is visible in the flushing water as it leaves the system.

D. Final fill:
1. All air vents shall be opened to allow air to escape during filling.

2. Reconnect all flex connections to equipment.
3. System shall be drained and filled with a local domestic/softened water mixture as required by chemical treatment supplier. System shall be filled with pressure reducing valve at the specified fill pressure.

E. Purging: Purpose is to remove all air from the system:
1. System shall be circulated for a minimum of one hour with water velocities of a minimum of 5 ft/sec or greater until all visible air is removed.

F. Final chemical addition: Purpose is to install chemicals during inhibitor as required:
1. After the above final fill and purging has been completed and accepted by the engineer/owner the final chemical addition can be done.
2. Chemical treatment shall be added to the system after thoroughly mixing water per the manufacturer's recommendations. Chemical treatment shall include inhibitors. Quantities and concentrations of inhibitor/chemicals should be applied per the manufacturer's specifications and approval submittals.
3. System water shall be tested for chemical inhibitor concentrations, reserve alkalinity and PH. Reports shall be submitted to engineer/owner.
4. All records and documentation shall be kept and given to the owner upon completion.

END OF SECTION

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SECTION 23 25 13

WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. ASTM D596 - Standard Guide for Reporting Results of Analysis of Water; 2018.

B. ASTM D1067 - Standard Test Methods for Acidity or Alkalinity of Water; 2016.

C. ASTM D1068 - Standard Test Methods for Iron in Water; 2015.

D. ASTM D1126 - Standard Test Method for Hardness in Water; 2017.

E. ASTM D3370 - Standard Practices for Sampling Water from Flowing Process Streams; 2018.

1.4 DESCRIPTION OF WORK

A. Work Included:Perform water analysis and provide all water treatment products, equipment and labor for testing, cleaning, flushing and dispensing products to control water quality for each system specified hereinafter as follows:
1. Chilled Water System
2. Hot Water System
3. Closed Circuit Condenser Water System

B. Chemicals: Provide, at no additional cost to the Owner, all chemicals required for operating and testing all water treatment systems prior to and for one (1) year after Substantial Completion.

C. Instructions: Provide operating and maintenance instructions for each water treatment system; include one set in each Owner's Manual and deliver one set to Owner's operating personnel.

D. Testing Equipment and Reagents: Furnish suitable water treatment testing equipment for each system, complete with apparatus and reagents necessary for operation prior to and for three (3) months after Substantial Completion.
1. Service Representative:
   a. Cleaning and Flushing test required verifying satisfactory completion of pipe cleaning.
   b. Provide water analysis report quarterly on each operating system.
   c. Annually perform microbiological culture study on the system to monitor bacteria.

E. Replacement and Rework: Replace defective or nonconforming materials and equipment with new materials and equipment at no additional cost to Owner for one (1) year after Substantial Completion; monthly reports shall be provided to the Owner and Architect/Engineer.

1. Guarantee:Provide system produced by manufacturer who is willing to execute the required guarantee.
    a. Agreement to Maintain:Provide system produced by manufacturer who is willing to execute (with the Owner) the required agreement for continued maintenance of the system.

1.5 QUALITY ASSURANCE

A. Qualifications: The Water Treatment Contractor for work under this Section shall have:
    1. Research and development facilities.
        a. Regional laboratories capable of making a water analysis.
        b. A service department and qualified technical service representative located within a reasonable distance of the project site.
        c. Service representatives who are Registered Engineers or factory-certified technicians with not less than five (5) years of water treatment experience with the water treatment system manufacturer. A Certified Water Technologist (CWT) qualified professional is preferred.

B. Packaging and Labeling: Water treatment chemicals will be supplied in a container suitable for product, and will be in accordance with DOT shipping standards.

C. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters Laboratories (UL) and which comply with National Electrical Manufacturers' Association (NEMA) standards.

D. Chemical Standards: Provide chemical products acceptable under state and local pollution control or other governing regulations.

1.6 SUBMITTALS

A. Test reports: Submit test reports certified by an officer of the firm, on water treatment company letterheads, of samples of each treated water system specified. Comply with ASTM D596 for reporting. Indicate the ASTM best methods for each test. Tests will included by are not limited to conductivity, pH, chemical residual, iron, copper, and bacteria count.

B. Shop Drawings: Submit shop drawings for each water treatment system. Show wiring, pumps, piping and tubing sizes, fittings, accessories, valves and connections and monitoring equipment.

C. Guarantee: Submit written guarantee, signed by the Manufacturer and countersigned by the Installer and Contractor, agreeing to adjust or replace the chemicals in the systems as required to achieve the required performance, during a one (1) year period following the final start-up or the continued operation of the systems.

D. Agreement to Maintain: Prior to the time of final acceptance, the Manufacturer of the water treating system shall submit four (4) copies of an "Agreement for Continued Service and the Owner's Possible Acceptance." Offer terms and conditions for furnishing chemical and providing continued testing and equipment for a one (1) year period with option for renewal of the Agreement by Owner.

1.7 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.
        a. Principle of how the equipment works.
        b. Important parts and assemblies.
        c. How the equipment achieves its purpose and necessary operating conditions.
        d. Most likely failure modes, causes and corrections.
        e. On site demonstration.

PART 2 - PRODUCTS

2.1 GENERAL

A. Water Analysis: Determine which chemicals to use from the results of a water sample analysis taken from the building site by the system manufacturer. Provide ingredients necessary to achieve the desired water conditions.

B. Pre-Treatment: Treat water piping systems with chemicals to remove and permit flushing of mill scale, oil, grease and other foreign matter.

C. FDA and USDA Approval: Use only FDA and USDA approved products in system with direct connection to domestic water systems.

D. Governing Laws: Ensure that neither products, waste, blow-down nor other effluents violate local, state, EPA, or other agency regulations in effect in the project area.

2.2 APPROVED WATER TREATMENT SERVICE

A. Water Treatment Services

B. Kurita (U.S. Water/ChemCal)

C. Chem Treat

D. Nalco

E. Garratt Callahan

2.3 CHILLED AND HOT WATER SYSTEMS

A. Chemicals: Provide water treatment products which contain inhibitors that perform the following:
1. Form a protective film to prevent corrosion and scale formation;
2. Scavenge oxygen and protect against scale;
3. Remain stable throughout operating temperature range, and;
4. Are compatible with pump seals and other elements in the system.
5. Corrosion inhibitor chemical – chill loop. This product must be in liquid form and impart the following active ingredients at the following dosages when fed in CHILL LOOP water: 1) nitrite (as NO2) = 400-800 ppm, 2) borate = 200-400 ppm, 3) azole = 20-60 ppm. The resulting bulk water pH range should be 9.0-10.5.
6. Corrosion inhibitor chemical – hot loop. This product must impart the following active ingredients at the following dosages when fed in HOT LOOP water: 1) nitrite (as NO2) = 800-1200 ppm, 2) borate = 400-600 ppm, 3) azole = 40-80 ppm. The resulting bulk water pH range should be 9.0-10.5., for aluminum condensing boiler molybdate at 10 to 25 ppm.

B. Equipment: For each system, provide a 5-gallon filter feeder constructed of materials which are impervious to the products dispensed. Feeder shall be designed for not less than 200-psig operating pressure. Filter feeder shall be as manufactured by Vector Industries model FA-900 or approved equal. Provide flow indicator meter on discharge of filter feeder.

C. Test Kit: Provide test kit and reagents for determining proper water conditions. Test kit should be capable of testing presence of corrosion inhibitor and pH. A handheld connectivity/TDS meter shall be part of the test kit package.

D. Treatment: Treat initial water charge to water system, after system has been flushed and prepped, to achieve a water quality as specified. Test report required to verify cleaning.

E. Reports: Prepare certified test report for each required water performance characteristic. Comply with the following ASTM standard, where applicable:
   1. ASTM D1067 – Tests for Acidity or Alkalinity of Water.
   2. ASTM D1068 – Tests for Iron in Water and Waste Water.
   3. ASTM D1126 – Tests for Hardness in Water.
   4. ASTM D3370 – Sampling Water.

PART 3 – EXECUTION

3.1 THE WATER TREATMENT CONTRACTOR

A. General: After piping systems are erected pressure tested and proven free of leaks, administer chemicals required for preparation treatment and flushing. Apply chemicals for the time period and in the concentration recommended by the water treatment manufacturer for this portion of the work. Flushing must be for a minimum of 24 continuous hours.

B. Testing:After completion of 24 continuous hours of flushing, perform test procedures and submit a written report of test conditions and results to the Engineer. If test results are unsatisfactory, repeat preparation treatment as necessary to achieve test results approved by the Owner's insurance carrier and the Engineer.

3.2 SERVICES OF MECHANICAL CONTRACTOR

A. Piping systems shall be pressure tested and approved for tightness, they shall be thoroughly cleaned and flushed using and approved pipe cleaning.

B. After initial chemical treatment has been added, the systems must be circulated for 48 hours with all valves opened; then the automated building system can be initiated.

3.3 PIPE CLEANING, STERILIZATION, AND FLUSHING

A. Additions/Renovations: When connecting new piping to existing piping, provide full size isolation valves at connection points and wire strainer with fine mesh screens.

B. All connections required for cleaning, purging and circulating shall be included as permanent installation with valves. Provide permanent pipe bypasses at each coil and heat exchanger during this cleaning operation and for future flushing. All air vents, gauges, strainers, etc., valved connections in piping systems shall be blown clean during cleaning and after cleaning operation is completed.

C. After cleaning, drain the system, fill with fresh water and flush thoroughly for a minimum of 48 hours or as recommended by Engineer.

D. All flushing, cleaning, and initial chemical treatment shall be complete and witnessed by Owner prior to starting systems.

E. Start-up procedures: During water system start-up, operate water treating system (after changing with specified chemicals) to maintain the required steady-state characteristics of water. Demonstrate system operation to Owner's operating personnel.

3.4 ADDITIONAL REQUIREMENTS FOR THE WATER TREATMENT CONTRACTOR

A. Vendor shall warrant the chemicals used in the water treatment program, and will have no detrimental effects on the metallic or non-metallic materials in the equipment being treated; if applied according to Vendor's instructions.

B. All testing of the Owner's systems are to be completed on-site and discussed with Owner's HVAC personnel with a copy of the report given to him/her for signature.

C. All work shall be performed in cooperation with Owner's HVAC personnel.

D. Periodic de-scaling with inhibited acids will not be considered as meeting this specification.

E. Sulfuric acid or other inhibited acids shall not be used in the chemical treatment program of Owner.

F. The Contractor shall provide a biocide program consisting of both an oxidizing biocide and bio-dispersant if required.

3.5 PERSONNEL TRAINING

A. Operator Training: Train Owner's personnel in use and operation of heating water, chilled water treating systems. A Program Administration Manual shall be furnished encompassing all systems in this section of the Specifications.

B. Provide two (2) hours in use and operation of water treating systems.

END OF SECTION

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SECTION 23 31 13

METAL DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Low pressure ductwork.

B. Medium and high pressure ductwork.

C. Casings.

D. Underground buried ducts.

E. Exposed ductwork located indoors.

F. Kitchen hood ductwork.

G. Domestic range hood exhaust ductwork.

H. Dishwasher/Shower/Locker room exhaust ductwork.

I. Laboratory fume hood exhaust ductwork.

J. Chlorine storage area ductwork.

K. Duct exposed in pool room or pool equipment room.

L. Welding exhaust ductwork.

M. Paint hood exhaust ductwork.

N. Commercial dryer vent.

O. Duct leakage testing.

P. Duct system protection.

Q. Duct system cleaning.

1.2 RELATED SECTIONS

A. Division 9 - Finishes: Weld priming, weather resistant, paint or coating.

B. Section 23 02 00 - Basic Materials and Methods for HVAC

C. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 07 13 - Duct Insulation

F. Section 23 33 00 - Ductwork Accessories

G. Section 23 37 13 - Air Distribution Devices

1.3 REFERENCES

A. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023b.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System; 2021.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

I. ASHRAE (FUND) ASHRAE Handbook - Fundamentals; Chapter 21 - Duct Design.

J. ASHRAE (HVACS) ASHRAE Handbook - HVAC Systems and Equipment; Chapter 19 - Duct Construction.

K. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N. ICC (IECC) - International Energy Conservation Code.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer’s Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

1.5 GENERAL DESCRIPTION

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.6 SUBMITTALS

A. Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

B. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

C. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.7 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B. Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2". Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2", and all supply ductwork downstream of terminal units in variable volume systems.

C. Medium Pressure: Medium pressure ductwork shall be rated for an operating pressure of 4". Medium pressure ductwork shall be defined as all supply ductwork extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4". The supply ductwork of constant volume air handling units having a scheduled external static pressure greater than 2" and less than 4" shall be rated for medium pressure.

D. High Pressure: High pressure ductwork shall be rated for an operating pressure of 6", or the scheduled external pressure of the equipment it is connected to, whichever is greater. The supply ductwork of air handling units having a scheduled external static pressure greater than 4" shall be high pressure.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A480/A480M; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Non-combustible and conforming to UL 181, Class 1 air duct materials.

B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 5M, Thermaflex MKE, ATCO #036 or approved equal.
   1. Flexible ducts shall be corrosive resistant galvanized steel formed and mechanically locked to inner fabric with minimum 1-1/2" thick, R-6 insulation. Flexible duct shall be rated up to at least 10 in.w.g. positive pressure and shall have reinforced metalized outer jacket to comply with UL 181, Class 1 air duct.

C. Sealants: Hard-Cast “iron grip” or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
   1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
   2. For aluminum ductwork, provide aluminum support materials.

2.3 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with latest SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer’s approval prior to using round duct in lieu of rectangular duct.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F. Use double nuts and lock washers on threaded rod supports.

2.4 MEDIUM AND HIGH PRESSURE DUCTS

A. Fabricate and support in accordance with SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.

C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) Standards and SMACNA High Pressure Duct Construction Standards and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gauge galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce doorframes with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cubic foot minimum glass fiber media, on inverted channels of 16 gauge.

2.6 BURIED UNDERGROUND DUCTS

A. Buried ducts may be concrete encased sheet metal or fiberglass reinforced plastic as indicated.

2.7 EXPOSED DUCTWORK LOCATED INDOORS

A. Where ductwork is indicated to be exposed to view in occupied spaces, provide round or flat oval, double wall galvanized steel construction with spiral lockseam with perforated inner liner, United McGill Corporation model Acousti-k27 or approved equal.

2.8 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA (DCS) Standards, and NFPA 96.

B. Construct of 16 gauge carbon steel or 18 gauge stainless steel, using continuous external welded joints.

C. Slope all duct toward the kitchen hood or a grease reservoir so that grease cannot collect in any portion of duct per mechanical code.

2.9 DOMESTIC RANGE HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA (DCS) Standards.

B. Construct of minimum 26 gauge galvanized steel.

2.10 DISHWASHER/SHOWER/LOCKER ROOM EXHAUST DUCTWORK

A. All ductwork shall be stainless steel, one gauge heavier than that required for galvanized steel duct.

B. Slope all duct to drain out grilles or provide drain line to floor drain.

2.11 LABORATORY FUME HOOD EXHAUST DUCTWORK

A. Construct of 18 gauge type 316 stainless steel.

B. All welded construction.

2.12 CHLORINE STORAGE AREA DUCTWORK

A. 18 gauge minimum galvanized steel.

B. Three coat minimum, acid resistance, epoxy paint, minimum 6 mil dry film thickness total, inside of duct and outside of duct.

C. Paint after fabrication including all taps and grilles.

2.13 DUCT EXPOSED IN POOL ROOM OR POOL EQUIPMENT ROOM

A. 18 gauge minimum galvanized steel.

B. Two coat galv-grip primer.

C. Three coat minimum, acid resistant epoxy paint, minimum 6 mil dry film thickness total, exterior of duct, color to be selected by architect in the field.

D. Paint after fabrication, including all hangers, taps, grilles, return air grilles and louvers.

2.14 WELDING EXHAUST DUCTWORK

A. Construct of galvanized steel with spiral lockseam. Provide duct gauges, reinforcing, and sealing for operating pressures indicated.

B. Joints and fittings shall be flanged construction. All joints shall be gasketed or sealed.

2.15 PAINT HOOD EXHAUST DUCTWORK

A. Construct of 18 gauge, Type 316 stainless steel.

B. All welded construction.

2.16 COMMERCIAL DRYER VENT

A. Construct of 18 gauge, Type 316 stainless steel.

B. All welded construction.

C. Provide hard duct connection to dryer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect terminal units to medium or high pressure ducts with 18 inches maximum length of flexible duct. Do not use flexible duct to change direction.

E. Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H. All ductwork located exposed on roof shall be "crowned" to prevent water from ponding. Ref: Insulation for additional requirements.

I. Where ducts pass through non-rated floors, provide structural angles for duct support. Where ducts pass through non-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches. Where ducts pass through rated interior partitions, rated exterior walls, or rated floors, install fire dampers or smoke dampers as required. Provide sleeves for dampers not provided with factory sleeve. Refer to Section 23 33 00 - Ductwork Accessories for fire and smoke damper requirements.

J. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

K. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

L. All duct hangers shall be attached to building structure. Cutting slots in roof or floor decking for hanger straps to be cast in concrete is not acceptable.

3.2 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA (DCS).

3.3 REQUIREMENTS FOR DUCTS BURIED UNDERGROUND

A. Slope underground ducts to plenums or low pump-out points at 1:500. Provide access doors for inspection.

B. Coat buried, metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.

C. Insulate buried supply duct runs over 50 feet long with one inch thick insulation covered with plastic vapor barrier.

D. Encase buried metal ductwork in 3 inch minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete placement. Introduce no heat into ducts for 20 days following placement of concrete.

3.4 REQUIREMENTS FOR UNIT CASINGS

A. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.5 REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCTWORK

A. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.

B. Provide access openings in each change in direction, located on sides of duct 1½" minimum from bottom, and fitted with grease-tight covers of same material as duct

C. Use stainless steel for ductwork exposed to view.

3.6 DUCTWORK APPLICATION SCHEDULE

A. Ductwork materials shall be provided to comply with the following:

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel, Aluminum
Buried Supply or Return	Concrete, Glass Fiber Reinforced Plastic
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Kitchen Hood Exhaust	Carbon Steel, Stainless Steel
Domestic Range Hood Exhaust	Galvanized Steel
Dishwasher/Shower/Locker Room/Dryer Vent/Paint Hood Exhaust	Stainless Steel
Fume Hood Exhaust	Stainless Steel
Chlorine Storage Supply and Exhaust	Galvanized Steel
Pool Room or Pool Equipment Room Supply, Return, and Exhaust	Galvanized Steel
Welding Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Emergency Generator Ventilation	Carbon Steel

3.7 DUCTWORK HANGERS AND SUPPORTS

A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B. Wire shall not be used for permanent support or attachment components

C. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.8 AIR DUCT LEAKAGE: (FROM SMACNA DUCT STANDARDS LATEST EDITION) TEST ALL DUCTWORK (DESIGNED TO HANDLE OVER 1,000 CFM) AS FOLLOWS:

A. Test apparatus
1. A source of high pressure air-a portable rotary blower or a tank type vacuum cleaner.

2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B. Test Procedures
1. Test for audible leaks as follows:
2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
   a. Start the blower with its control damper closed.
   b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
   c. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
   a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
   b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
   c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
   d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.
4. Testing Report
   a. Contractor shall provide a testing report for each air system to the engineer. The report shall indicate the completion of testing and compliance with testing specification.
   b. All duct testing reports shall be included in the final close out documents.

3.9 DUCT SYSTEM PROTECTION

A. Provide temporary closures at the ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation; provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

B. Provide temporary construction filters on air handling equipment and/or return air ductwork during construction to protect ductwork and equipment from dust.

C. Any ductwork stored on site with observable dirt or debris inside shall be cleaned by a third party.

D. If the air handling system has been operated without temporary construction filters or if the integrity of the temporary closures has been compromised, the contractor shall have the duct system cleaned per the following section.

3.10 DUCT SYSTEM CLEANING

A. For renovation projects and HVAC retrofit applications wherein existing duct systems are scheduled to be re-used, or where required by the Duct System Protection section above, the contractor shall have the existing duct systems cleaned in accordance with the current published standards of ASHRAE, NADCA ACR and as indicated below.

B. Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

E. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

F. Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

G. Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

H. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

I. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

J. Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.11 DUCT JOINTS AND SEAMS

A. All ductwork shall be constructed to Seal Class A, as referenced in SMACNA (DCS).

B. All non-welded joints and seams shall be sealed. This includes but is not limited to:
1. Transverse joints.
2. Longitudinal seams.
3. Duct wall penetrations.
4. Spin-ins, taps, and other branch connections.
5. Access doors, access panels, and duct connections to equipment.

C. Openings for rotating shafts shall be sealed with bushings.

END OF SECTION

SECTION 23 33 00

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Volume control dampers.

B. Shutoff Dampers.

C. Round Duct Taps.

D. Conical Duct Taps.

E. Fire dampers.

F. Combination fire and smoke dampers.

G. Back draft dampers.

H. Air turning devices.

I. Flexible duct connections.

J. Duct access doors.

K. Duct test holes.

1.2 RELATED WORK

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

C. Section 23 31 13 - Metal Ductwork

1.3 REFERENCES

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

F. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

G. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

H. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.

C. Submit manufacturer's installation instructions under provisions of Division 1, for fire dampers and combination fire and smoke dampers.

PART 2 - PRODUCTS

2.1 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS), and as indicated.

B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.

D. Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.

E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch.
1. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.

F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.2 SHUTOFF DAMPERS

A. Fabricate in accordance with SMACNA (DCS), and as indicated.

B. Provide Class I multi-blade damper of parallel blade pattern for all ductwork systems which penetrate the building thermal envelope in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.
1. Damper shall be constructed of one-piece 16 ga. roll-formed galvanized steel hat-shaped channel frame. Blades shall be 14 ga. roll-formed galvanized steel, airfoil type. Blade edge seals shall be neoprene gaskets mechanically locked to blade edge. Bearings shall be 304 stainless steel, oil-impregnated and self-lubricating sleeve type, turning in extruded holes in damper frame.

C. Shutoff dampers shall have an air leakage rate not greater than 4 cfm/ft^2 of damper surface area at 1.0 in.w.g. and shall be labeled by an approved agency when tested in accordance with AMCA 500-D for such purpose.

2.3 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

A. Greenheck.

B. Louvers and Dampers Inc.

C. Ruskin.

D. Nailor Industries.

E. Pottorff.

2.4 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream. Provide factory sleeve for each damper.

C. Fabricate multiple blade fire dampers per UL with 16 gauge minimum galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

D. Fusible links, UL 33, shall separate at 165 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.5 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S and as indicated.

B. Provide factory sleeve for each damper. Install damper operator on exterior of sleeve and link to damper operating shaft.

C. Fabricate with multiple blades with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
1. Operators shall be spring return electric type suitable to operate on 120 VAC, 60 cycle.
2. Operators shall be UL listed and labeled.

2.6 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, UL 555S and as indicated.

B. Motorized Smoke Dampers: multi-blade type, normally open with power on, close automatically when power is interrupted, UL-listed and labeled damper and damper operator.

2.7 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A. Greenheck.

B. American Warming and Vent.

C. Louvers and Dampers Inc.

D. Ruskin.

E. Pottorff.

F. Substitutions: Under provisions of Division One.

2.8 BACKDRAFT DAMPERS

A. Gravity back draft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturers standard construction.

B. Fabricate multi-blade, parallel action gravity balanced back draft dampers of 16 gauge galvanized steel, or extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

C. Gravity backdraft dampers shall have an air leakage not greater than 20 cfm/ft^2 where not less than 24 inches in either dimension and 40 cfm/ft^2 where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 in.w.g. when tested in accordance with AMCA 500-D for such purpose.

2.9 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

A. Metaledge.

B. Ventglass.

C. Substitutions: Under provisions of Division One.

2.10 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 6 inches wide, crimped into metal edging strip.

2.11 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

A. Greenheck.

B. American Warming and Vent.

C. Ruskin.

D. Titus.

E. Substitutions: Under provisions of Division One.

2.12 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Review locations prior to fabrication.

C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F. Access doors with sheet metal screw fasteners are not acceptable.

2.13 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.

B. Balancing Dampers
1. Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.
2. All regulators mounted on externally insulated ductwork shall have 16 gauge elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No. 607 bearing mounted on ductwork within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.
3. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.

C. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

E. Provide gravity backdraft dampers or motorized shutoff dampers in accessible location nearest to exterior wall/roof penetrations and where indicated for all outdoor air intake and exhaust systems to automatically shut when the associated systems or spaces served are not in use.

F. Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections.

G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

H. Provide duct access doors for inspection and maintenance of all fire dampers, smoke dampers, and combination fire/smoke dampers. Provide minimum 12 x 12 inch size access opening where duct size permits. All duct sizes that cannot accommodate a minimum 12 x 12 inch access opening shall be provided with a removable duct section to permit inspection and maintenance of the damper and its operating parts. Removable duct sections shall match the pressure class of the associated duct system, maintain 100 percent of the duct free area, and utilize gaskets and clamp type draw latches to allow removal and reinstallation without the use of tools.

I. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Centrifugal roof ventilators

B. Ceiling and inline ventilators

C. Roof supply fans

D. Utility fans

E. Kitchen hood upblast roof exhaust fans

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 09 63 - Energy Management and Control System (EMCS)

F. Section 23 33 00 - Ductwork Accessories

1.4 REFERENCES

A. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

C. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

D. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

E. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016.

F. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

H. FLA (FBC-B) - Florida Building Code: Building (8th Edition); 2023, with Supplement (2024).

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. Miami (APD) - Approved Products Directory; Miami-Dade County; Current Edition.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

N. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

O. UL 705 Supplement SC - (Formerly UL-762) - Standard Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

P. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.5 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705.

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70.

F. Sound Power Level Ratings: Comply with AMCA 301. Test fans in accordance with AMCA 300. Fans shall be licensed to bear the AMCA 300 Seal.

G. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210.

H. Motors for fans that are not less than 1/12 hp (0.082 kW) and less than 1 hp (0.746 kW) shall be electronically commutated motors per ICC (IECC) and ASHRAE Std 90.1 I-P.

I. High Wind models shall be analyzed and stamped by a state license P.E. to the ASCE 7-16 Standard which meets the ICC (IBC), FLA (FBC-B), and Miami (APD) codes.

J. Each High Wind model is subject to be certified by a Nationally Recognized Testing Laboratory to ASTM E330/E330M.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:
1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and fan accessories.
4. Materials, gages and finishes, include color charts.
5. Dampers, including housings, linkages, and operators.
6. Full color paint samples.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

F. Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

G. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

H. Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be stored and handled in accordance with the unit manufacturer’s instructions.

B. Lift and support units with the manufacturer`s designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer`s written instructions.

D. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Greenheck Fan Corporation

B. Loren Cook Company

C. Pennbarry

D. ACME

E. Twin City Fan and Blower

2.2 GENERAL DESCRIPTION

A. Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B. Fans and Shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

C. Provide factory baked-enamel finish coat after assembly. Color for roof mounted fans shall be chosen by Architect during the submittal process.

2.3 CENTRIFUGAL ROOF VENTILATORS

A. Fan shall be a spun aluminum, centrifugal, roof mounted, direct driven or belt driven as indicated.

B. Fan shall be UL 705 listed. Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

D. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. A discharge baffle conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.

E. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in transit tested packaging.

F. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA 204, balance quality and vibration levels for fans.

G. Motor shall be heavy duty type with permanently lubricated sealed ball bearings.

H. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty re-greaseable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

I. Accessories: The following accessories are required.
1. Disconnect Switch: Non-fusible type, with thermal overload protection, mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.
3. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - Ductwork Accessories.
4. Roof Curbs: Prefabricated, minimum 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and fan base. Roof curb shall match roof slope so that the curb is level.

2.4 ROOF SUPPLY FANS

A. Roof-mounted, filtered air supply units are of the belt-driven, double width, double inlet (DWDI), forward curved centrifugal blower type. The unit's blower assembly shall be mounted on vibration isolators. Motor drives shall be machine cast iron and variable pitch and shall be factory set to the specified RPM. Belts shall be non-static and oil resistant. Both motor and blower bearings shall be permanently lubricated with sealed ball bearings. The blower housing shall be fabricated of heavy gauge painted steel.

B. Fan shall be UL 705 listed and shall bear the AMCA certified rating seal for sound and air performance.

C. Units housing shall be minimum 18 gauge extruded aluminum with a removable aluminum cover. The insulated cover shall be held in place with bolts for easy access to fan components.

D. Filters shall be permanent, one inch, washable, aluminum type and shall be easily removed for cleaning. Units carry the AMCA Certified Ratings Seal for air performance with filters in place.

E. Accessories: The following items are required.
1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.
3. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - Ductwork Accessories.
4. Roof Curb: Prefabricated, minimum 12 inch high, heavy gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and fan base.

2.5 KITCHEN HOOD UPBLAST ROOF EXHAUST FANS

A. General Description
1. Discharge air up and away from the mounting surface.
2. Upblast fan shall be for roof mounted applications.
3. Maximum continuous operating temperature is 400°F.

4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B. Fan shall be direct-driven or belt-driven as indicated.
   1. Fan Wheel
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum, statically and dynamically balanced in accordance to AMCA 204.
      c. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
   2. Housing
      a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.
      f. Provide an access opening on the curvature of the outer fan housing to allow for cleaning and inspection of the fan blades per NFPA 96. Access opening shall be a minimum 3 in. by 5 in. rectangular or minimum 4 in. diameter circular opening.

C. Shafts and Bearings
   1. Fan Shaft
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

D. Drive Assembly
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
   2. Belts: Static free and oil resistant.
   3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   4. The motor pulley shall be adjustable for final system balancing.
   5. Readily accessible for maintenance.

E. Roof Curb: Minimum 12-inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, ventilated double wall, and factory installed nailer strip. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Roof curb shall match roof slope so that the curb is level.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Accessories: The following accessories are required.
   1. Birdscreen
      a. Provide aluminum construction.
      b. Protects fan discharge.
   2. Roof Curb Extension: Provide vented curb extension per NFPA 96. Verify curb height with extension has a minimum of 40 inches clearance from the discharge lip of the fan to the finished roof.
   3. Drain Connection:
      a. Aluminum construction.
      b. Allows single-point drainage of grease, water, or other residues.
   4. Grease Trap:
      a. Provide aluminum grease receptacle as required by NFPA 96.
      b. Includes drain connection.
      c. Collects grease residue.
   5. Hinge Kit (factory Installed)
      a. Aluminum hinges.
      b. Hinges and restraint cables mounted to base (sleeve).
      c. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning.
   6. Heat Baffle:

a. Provide 1-inch thick insulation shield that prevents heat from radiating into the motor compartment to meet requirements of UL 705 Supplement SC.

7. Variable Speed Control:
   a. Provide an electronically commutated motor or a premium efficiency AC induction paired with a variable frequency drive capable of variable speed control for demand-based ventilation sequencing as required by the kitchen hood ventilation controls.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

D. Refer to 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment for additional installation requirements.

E. Flexible duct connections and shutoff dampers are prohibited from being installed in duct systems conveying grease laden exhaust air per NFPA 96 requirements.

END OF SECTION

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SECTION 23 36 23

DUAL DUCT AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Dual duct terminal units.

B. Integral damper motor operators.

C. Integral controls.

1.2 RELATED SECTIONS

A. Section 23 31 13 - Metal Ductwork

B. Section 23 33 00 - Ductwork Accessories

C. Section 23 09 63 - Energy Management and Control System (EMCS)

D. Section 26 29 26 - Miscellaneous Electrical Controls and Wiring

1.3 REFERENCES

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.4 QUALITY ASSURANCE

A. Terminals shall be AHRI 880 (I-P) certified and carry the AHRI Seal.

B. The entire terminal and all electrical components shall be UL listed.

1.5 SUBMITTALS

A. Submit shop drawings under provisions of Division 01.

B. Submit shop drawings indicating configuration, general assembly, and materials used in fabrication.

C. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and NC designation.

D. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of one to 4 inch wg (250 to 1000 Pa).

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division One.

B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

C. Include directions for resetting constant volume regulators.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

1.8 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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. TITUS

B. METALAIRE

C. KRUEGER

D. PRICE

2.2 MANUFACTURED UNITS

A. Above ceiling mounted, variable air volume, double duct, supply air control terminals for connection to dual medium pressure duct, central air systems, with digital control.

B. Identify each airflow unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory set air flow, minimum factory set air flow, and coil type.

C. Maximum differential static pressure drop across unit shall not exceed 0.50 in.w.g.

2.3 FABRICATION

A. The terminal casing shall be minimum 22 gauge galvanized steel, internally lined with 1" natural fiber or fiberglass free insulation which complies with UL 181 with regard to resistance to erosion and mold growth and NFPA 90A. Insulation shall have R-value of 4.0. Exposed fiberglass is not acceptable. The insulation shall be mechanically fastened to the unit casing. The fasteners shall be weld pins. Lining material glued in place without mechanical fasteners are not acceptable. Any exposed insulation edges shall be coated with NFPA 90A approved sealant, or covered with galvanized brackets or foil tape. The casing shall be provided with mounting brackets for hanging from structure.

B. Assembly: Air volume damper, mixing air chamber, and controls in single cabinet.

C. Plenum Air Inlets: Round/oval stub connections for duct attachment.

D. Plenum Air Outlets: S and drive connections.

E. Mixing Sections: Each terminal shall include a mixer-attenuator section as an integral part of the terminal to minimize downstream stratification. The terminal shall provide less than 2°F, EDV/EDC (or 1°F, MDV/MDC) discharge temperature variation with a 20°F differential in inlet temperature.

2.4 VOLUME DAMPER

A. Locate air volume damper assembly inside unit casing. Construct from extruded aluminum or 20 gage (0.9 mm) galvanized steel components. The damper shaft shall be rotating in Delrin self-lubricating bearings. Nylon bearings are not acceptable. Shaft shall be clearly marked on the end to indicate damper position. Stickers or other removable markings are not acceptable. The damper shall incorporate a mechanical stop to prevent over stroking and a synthetic seal to limit close-off leakage

B. Automatic flow control assembly shall combine spring rates matched for each volume regulator size with machined dashpot for stable operation.

C. Air volume control damper shall be factory calibrated assembly consisting of damper and damper shaft extension for connection to externally mounted control actuator.

D. Externally mounted electronic actuator shall position damper normally open.

2.5 CONTROLS

A. The terminal unit manufacturer shall mount the pressure independent electronic controls provided by section 23 09 63.

B. The terminal unit shall incorporate a multi-point, center-averaging velocity sensor. A minimum of four measuring ports must be parallel to the takeoff point from the sensor. Sensors with measuring ports in series are not acceptable. The sensor must provide a minimum differential pressure signal of 0.03 in.w.g. at an inlet velocity of 500 fpm. The sensor must provide airflow control signal accuracy of ±5%, with a hard 45° or 90° elbow attached directly to the inlet.

C. Tubing from airflow cross sensor to the DDC controller shall be Tygon tubing or approved equal.

D. Flow measuring taps and flow curves shall be supplied with each terminal for field balancing airflow. Each terminal shall be equipped with labeling showing unit location, size, minimum and maximum cfm setpoints, damper fail position, QR code label as per submittal section, and thermostat action.

2.6 TESTS

A. Provide testing of units.

B. Test run volume dampers and controls. Check sequence of operation and air flow limits at factory prior to shipment.

C. Base performance on tests conducted in accordance with ADC 1062.

D. Automatic flow controller shall be capable of maintaining air flow to within 5 percent of set point with inlet static pressure variations up to 2 inches.

E. Maximum Casing Leakage: 2 percent of design air flow at rated inlet static pressure.

F. Maximum Damper Leakage: 2 percent of design air flow at two inch inlet static pressure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Connect to ductwork in accordance with Section 23 31 13.

E. Must be installed in an accessible location for maintenance and service with no obstruction to service panels and controls.

END OF SECTION

SECTION 23 41 00

AIR FILTERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 - PRODUCTS

2.1 FILTERS

A. Air filters shall be high efficiency ASHRAE pleated panels consisting of synthetic media, welded wire media support grid, and beverage board enclosing frame, AAF PREpleat M13, 2-inch thick or approved equal.

B. APPROVED MANUFACTURERS
1. American Air Filter.
2. Camfil.
3. Airguard Industries, Inc.
4. Cambridge.
5. Filtration Group

2.2 LOW VELOCITY FILTER SECTION

A. Filters shall be of the throwaway cartridge type in 2-inch frames. When installing multiple filters into slide-in frames tape adjacent filters together with duct tape to prevent bypassing of air around the filter. Media shall be rated at 500 feet per minute.

B. Filtering media shall be formed of non-woven reinforced synthetic type filtering media bonded to 96% open area media support grid folded into a non-creased radial pleat design. The filter pack shall be bonded to the enclosing frame to prevent air bypass. Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of ASHRAE Std 52.2. Initial resistance shall not exceed 0.30 inches water gauge at 500 fpm face velocity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Filters shall be provided upstream of all cooling coils or other devices with wetted surfaces through which air is supplied to occupiable spaces per ASHRAE Std 62.1.

B. Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inches w.g. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label.

C. Refer to Section 23 02 00 for additional filter information.

END OF SECTION

SECTION 23 73 13

MODULAR INDOOR CENTRAL STATION AIR HANDLING UNITS (FALCON PASS)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Indoor central station air handling unit.

1.2 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping

C. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

D. Section 23 05 26 - Variable Frequency Motor Speed Control for HVAC Equipment

E. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

F. Section 23 07 13 - Duct Insulation

G. Section 23 31 13 - Metal Ductwork

H. Section 23 33 00 - Ductwork Accessories

I. Section 23 34 00 - HVAC Fans

J. Section 23 41 00 - Air Filters

1.3 REFERENCES

A. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2011.

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

C. AHRI 430 (I-P) - Performance Rating of Central Station Air-handling Unit Supply Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

G. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

H. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NEMA MG 1 - Motors and Generators; 2021.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.4 QUALITY ASSURANCE

A. Unit performance shall be certified in accordance with AHRI 430 (I-P) for central station air handling units.

B. Coil performance shall be certified in accordance with AHRI 410.

C. Direct-expansion coils shall be designed and tested in accordance with ASHRAE Std 15 Safety Code for Mechanical Refrigeration.

D. Insulation and insulation adhesive shall comply with NFPA 90A requirements or flame spread and smoke generation.

E. Unit shall be rated for sound performance in accordance with AHRI 260 and AMCA 300.

F. Unit shall be provided to comply with the maximum allowable fan horsepower per ICC (IECC) and ASHRAE Std 90.1 I-P.

1.5 GENERAL DESCRIPTION

A. Indoor mounted, central station air handling unit designed to provide air to a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration, and distribution. Unit shall be assembled for horizontal/vertical application and arranged to discharge conditioned air as shown on the drawings. Units shall be supplied by the specified manufacturer.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

G. Submit manufacturer’s installation instructions under provisions of Division One.

H. Submit operation and maintenance data under provisions of Section 23 02 00.

I. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.7 WARRANTY

A. The air handling unit manufacturer shall warrant parts and labor for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of start-up, whichever occurs first.

1.8 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, and fan has been test-run under observation.

1.10 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.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Trane

C. Daikin

D. Temtrol

2.2 GENERAL DESCRIPTION

A. Unit shall be factory supplied, central station air handler suitable for the capacities and configurations as shown on drawings. Unit may consist of a fan and coil section with a factory installed chilled water or direct-expansion coil, heating coil section, electric heat section, face and bypass section, filter section, access section, mixing box or combination filter-mixing box, return fan, diffuser, or air blender as indicated on the drawings.

B. All sections, whether assembled into a unit or supplied as separate components, shall have mating flanges for bolted assembly. The flange shall extend around the complete perimeter of each section. The manufacturer shall supply bolts and sufficient closed cell gasket for full perimeter coverage.

2.3 CASING

A. All unit sections shall be supplied with a formed galvanized steel perimeter base rail of at least 6 inches in height designed to support the weight and structural integrity of the unit. Condensate drain connection will not penetrate the base rail. If external isolators are not used, provide 6 inch minimum height housekeeping pads or sufficient overall height to provide p-trap with 1 inch greater that unit total static pressure.

B. Unit panels for all sections shall be double wall construction and shall be constructed of minimum 22 gauge mill galvanized steel. Casing panels shall be fully removable for easy access to the unit, and shall be secured to structural frame with aluminized or cadmium plated screws. Removal of panels must not affect the structural integrity of the unit. All panels shall have a minimum of 2-inch thick foam insulation (R-13). All panels shall be completely gasketed prior to shipping.

C. Casing air leakage shall not exceed Leakage Class 6 per ASHRAE Std 111 at +/- 8” w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE Std 111 Leakage Class in the submittal. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8” w.g., whichever is less, and shall not exceed 0.0042” per inch of panel span (L/240). Floor panels shall be double-wall construction and designed to support a 300 lb. load during maintenance activities and shall deflect no more than 0.0042” per inch of panel span.

D. Double wall hinged removable access doors with multiple handles shall be provided in the fan, coil, and filter sections on the drive side of the unit. Access doors must also be provided in all sections where the removal of sheet metal screws is required for unit access. Doors shall be of the same thickness and construction as the wall panels. A gasket shall be provided around the entire door perimeter. Access sections shall be installed where indicated on the drawings and shall be double walled hinged door.

2.4 FANS

A. Units shall be provided with direct-driven, single-width, single-inlet (SWSI) airfoil plenum fans constructed per AMCA requirements for the duty specified. Class I fans are not acceptable. Fan wheels shall be aluminum construction and rated in accordance with and certified by AMCA 210. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan’s peak static pressure producing capability at the specified fan/motor speed. Fans shall be selected such that the operating speed at peak design airflow conditions is not greater than 25% above the associated motor synchronous speed. Fans driven by motors operated by variable frequency drive shall not exceed the maximum fan RPM allowed by the manufacturer under a bypass condition. Each fan/motor assembly shall include a minimum 14 gauge spun steel fan inlet funnel, and a Ggalvanized steel motor support plate and fan base with 2" spring type vibration isolation. Provide horizontal spring type thrust restraints between the unit casing and each fan/motor assembly.

B. Units delivering supply airflow rates of significant magnitude shall be equipped with multiple supply fans in an array configuration. Refer to scheduled values to verify motor quantity per unit. Where multiple fans are provided, backdraft dampers shall be mounted upstream of each fan for isolation and a single source power motor control panel shall be factory installed. All fans shall be factory-wired to motor control panel which shall consist of individual motor overload relays and on-off disconnect switch for power isolation.

2.5 MOTORS

A. All motors shall be premium efficiency, totally enclosed fan-cooled (TEFC), selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG 1 Part 30 and 31, section 4.4.2. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedules.

B. All fan motors shall be operated from variable frequency drives. Variable frequency drives shall be furnished, installed, and wired by the installing Contractor. Reference Section 23 05 26 - Variable Frequency Motor Speed Control for HVAC Equipment for additional VFD requirements. A factory inverter drive balance shall be performed on all air handling units to identify resonant frequencies. A report of the results shall be provided for unit startup purposes.

C. All motors operated by variable frequency drive shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.

2.6 COILS

A. All coils shall be tested at 300 psig air pressure, under water.

B. All coils shall be installed on tracks for easy removal from the air handling unit. Units that require disassembly of the unit for coil removal are not acceptable.

C. Coils shall be aluminum plate fin type with belled collars and shall be bonded to 1/2 inch or 5/8 inch OD copper tubes by mechanical expansion. Coils shall have headers with steel MPT connections. Working pressure shall be 250 psig at 300°F.

D. Coils shall be drainable and have non-trapping circuits. Headers shall have drain and vent connections extended to the outside of the unit casing. Supply and return headers shall be clearly labeled on the outside of the unit. Provide grommets at all pipe penetrations through cabinet.

E. Main drain pan shall be double wall stainless steel with minimum 2 inch insulation, sloped toward drain fitting, with integral elbow for side discharge and FPT connection, and shall comply with ASHRAE Std 62.1. A maximum of one drain shall be supplied for each cooling coil section which shall extend at least 18” downstream of the coil. The unit design shall not require a drain pan in any downstream section to contain the coil condensate. Moisture shall not carry over past the coil. Moisture eliminators are not acceptable for moisture carryover prevention.

F. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on equipment schedule.

G. Coils in series shall have a minimum of 14 inch access section between coil casings.

H. In units larger than 10,000 cfm, coils shall be removable through a service panel without disassembly of the unit.

2.7 FILTERS

A. Filter section shall accept 2 inch or 4 inch filters of standard sizes as indicated on drawings and shall be designed and constructed to house the type of filter specified. Section shall include side access slide rails.

B. A minihelic or magnahelic differential pressure gauge shall be factory installed and flush mounted on drive side to measure the pressure drop across the filter.

C. A dirty filter allowance of 0.50” w.g. shall be incorporated into the total static pressure calculation of each air handling unit filter section.

D. Reference Section 23 41 00 - Air Filters for additional requirements.

2.8 MIXING BOXES AND INLET PLENUMS

A. Field fabricated mixing boxes and sheet metal plenums shall be provided by the installing Contractor where indicated on the Mechanical Drawings. When field fabricated mixing boxes are provided, the installing Contractor and EMCS Contractor shall provide outside air and return air motorized control dampers and actuators.

2.9 ACCESSORIES

A. All damper blades shall be galvanized steel, double skin airfoil type, housed in a galvanized steel frame and mechanically fastened to a hex axle rod rotating in stainless steel bearings. Dampers shall be sectionalized to limit blade length to no more than 48 inches so as to minimize blade warpage. Blade seals are required to assure tight closure. The damper shall be rated for a maximum leakage rate of 1 percent of nominal airflow at 1 inch w.g.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If floor mounted air handling units are furnished with internal vibration isolation option, provide 2" thick Amber/Booth type NRC ribbed neoprene pads or approved equal to address high frequency breakout and provide additional unit elevation with overall sufficient height to provide p-trap with one inch greater than the unit total static pressure. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer’s recommendations. Condensate drain connection shall not penetrate the base air handling unit’s rail.

B. Contractor to ensure that recommended clearence is maintained for proper access to service panels, control devices, etc. for maintanence purposes.

C. Install in accordance with manufacturer’s instructions.

D. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

E. Make electrical connections, taking care that these do not block access to any part of the equipment requiring service.

F. Unit wiring shall comply with NFPA 70 and all applicable UL standards.

G. Connect full size condensate drain pipe to air handling unit and extend to nearest drain.

H. Unit installation shall comply with NFPA 90A requirements.

I. System Startup Requirements: The installing Contractor service technician shall startup all air handling units. Technician shall at a minimum perform the following steps for each unit:
1. Energize the unit disconnect switch.
2. Verify correct voltage, phases and cycles.
3. Energize fan motor and verify correct direction of rotation.
4. Re-check damper operation: verify that unit cannot and will not operate with all dampers in the closed position.
5. Energize fan motors and verify that motor FLA is within manufacturer’s tolerance of nameplate FLA for each phase.
6. Program unit VFD to skip or lockout resonant frequencies that were identified by the manufacturer’s factory inverter drive balance to prevent the VFD from continuously operating at these frequencies.

J. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fans have been test run under observation.

K. The installing Contractor shall comply with manufacturer's start-up requirements to ensure safe and correct operation.

END OF SECTION

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SECTION 26 02 00

BASIC MATERIALS AND METHODS FOR ELECTRICAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning electrical system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.3 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

C. Division One

1.4 COOPERATION WITH TRADES

A. Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.5 REFERENCES

A. National Electrical Code (NEC)

B. American Society for Testing and Materials (ASTM)

C. Underwriter's Laboratories, Inc. (UL)

D. Insulated Cable Engineer's Association (ICEA).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronic's Engineers (IEEE).

G. American National Standards Institute (ANSI).

H. National Fire Protection Association (NFPA).

I. International Energy Conservation Code (IECC).

1.6 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.
   1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
   2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.7 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.8 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.9 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:
   1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
   2. An index page with a listing of all data included in the Submittal.
   3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
   4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
   5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
   6. Identification of each item of material or equipment matching that indicated on the Drawings.
   7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
   8. Additional information as required in other Sections of this Division.
   9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
   1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Furnish detailed shop drawings, descriptive literature, table of contents listing all items being submitted at the beginning of each submittal package, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:
1. Switchboards
2. Distribution Panelboards
3. Panelboards
4. Wiring Gutters
5. Heavy Duty Disconnect Switches
6. Lighting Fixtures
7. Lighting Contactors
8. Time Clocks
9. Lighting Control System
10. Photocells
11. Wiring Devices and Plates
12. Conduit and Fittings
13. Wire
14. General Purpose Dry Type Transformers
15. Harmonic Mitigating Type Transformers
16. Emergency Generator
17. Automatic Transfer Switches
18. Sound Reinforcing System
19. Fire Alarm System
20. Surge Protection Devices (SPD)
21. Lightning Protection

I. Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
      a. Wall and type locations.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm and sanitary sewer piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.
   2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 26.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

E. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

F. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow 1/4” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and ed for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26, include the following information for equipment items:
1. Identifying names, name tags designations and locations for all equipment.
2. Fault Current calculations and Coordination Study.
3. Reviewed shop drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and conduit.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data’s creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor’s sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect’s written consent.

1. It is agreed that “MEP” hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
2. If the client, Architect or Owner of the project requires electronic media for “record purposes”, then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD’s. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner’s request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a “.rvt” or “.dwg” format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:
   1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
   2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
   3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.2 PRODUCT LISTING

A. Products used on this project shall be listed by Underwriters' Laboratories.

2.3 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.4 EQUIPMENT PADS

A. Provide 4-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B. Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

C. Provide a minimum 6-inch-high, steel reinforced concrete pad for generators. Pads shall be sized 6" larger that the outside perimeter dimensions. Provide a 4-foot monolithic extension to the pad around the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.). Refer to structural details. Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise. The generator shall be bolted to the concrete pad per the manufacturers details.

D. Provide steel reinforced concrete pad for utility transformers. Pads shall comply with Utility Company Standards.

2.5 ESCUTCHEONS

A. Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.6 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.7 PAINTING

A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.8 ELECTRICAL SYSTEM IDENTIFICATION

A. Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Indicate voltage for that raceway. Locate markers at ends of conduit runs, on pull boxes, on junction boxes, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit. Switch-leg conduit and short branches for power connections do not have to be marked, except where conduit is larger than ¾ inch. Branch circuit conduits, junction boxes and pull boxes shall be marked with a permanent marker indicating panel name and branch circuit numbers.

B. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way. Provide black back plate with white letters and numbers for normal equipment. Provide red back plate with white letters and numbers for optional emergency equipment. Provide yellow back plate with white letters and numbers for Life safety equipment.

2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each automatic transfer switch, switchboard, distribution panel, motor control center, motor starter panels and panelboards.
   a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:
      1) Name
      2) Voltage
      3) Phase
      4) "3" or "4" wire, and
      5) Where it is fed from.
   b. An example of a panelboard nameplate is:
      Center Panel – 1HB
      480/277 volt, 3 phase, 4 wire
      Center Fed from DP2
   c. An example of an automatic transfer switch nameplate is:
      Center ATS #2
      480/277 volt, 3 phase, 4 wire, 4 pole
      Center Fed from MSB and DPE
3. Each feeder device in a switchboard, distribution panel, and motor control center device shall have a nameplate showing the load served in ½ inch high engraved letters.
4. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each transformer, safety switch, disconnect switch, individual motor starter, enclosed circuit breaker, wireway, and terminal cabinet.
   a. Identifying nameplates shall have 1/4 inch high engraved letters and shall indicate the equipment served.
   b. An example of a disconnect switch is: AHU-1.
5. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.
6. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
7. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

D. Identification of Wiring Devices
   1. Contractor shall indicate the circuit serving each wiring device. Provide a typewritten label located on the inside face of the coverplate for all recessed mounted devices and on the outside face of the coverplate on all surface mounted devices.

PART 3 - EXECUTION

3.1 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.2 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:
   1. Where shown to be exposed.
   2. Where exposure is necessary to the proper function.

3.3 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B. Contractor shall install underground raceways including but not limited to feeders, service laterals, branch circuit and telecommunications. Contractor shall saw cut existing hard surfaces, when required for installation. Contractor shall patch surface to match existing conditions. Contractor shall replace all landscaping material when raceways are installed in these areas. Submit proposed method for patching for review.

C. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

D. All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by “3M” or approved equal.

E. Refer to 26 05 33 for additional requirements.

3.4 ELECTRICAL GEAR

A. Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.

B. Lighting contactors, time clocks, fire alarm equipment, security equipment disconnect switches, etc. mounted in mechanical/electrical rooms shall be mounted at a working height not requiring a ladder, when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices (note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

C. Fire retardant back boards secured to drywall studs may be used for contactors, time clocks, fire alarm equipment, security equipment, and disconnect switches 60 amp or smaller. All other wall mounted devices shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

3.5 CLEANING

A. Clean lighting fixtures and equipment.

B. Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

3.6 CORROSIVE AREAS

A. In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.7 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division I.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection:
1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
2. Panelboards, switches, fixtures, etc., shall be cleaned and in operating condition.
3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

F. The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to all switchboards, distribution panelboards, panelboards, automatic transfer switches and other electrical distribution devices. This test shall be conducted to locate high temperature levels. This test shall be conducted between 3 to 8 months after occupancy, but not beyond the one year warranty period. Submit test to the architect and engineer using test reporting forms. All unacceptable conditions shall be corrected prior to the end of the warranty period.

END OF SECTION

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SECTION 26 02 01

COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Mechanical, Electrical, Plumbing, and Fire Protection Contractors shall prepare their work and generate 3D models which will be given to the Contractor for coordination. The Contractor will be provided with the REVIT model that was used to generate the contract documents, this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT, but may use any 3-D software in generating and combining the coordination model.

C. Submitting the contract drawings as coordination drawings will not be acceptable.

D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.

G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
   1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
      a. Wall and type locations.
      b. Clearances for installing and maintaining insulation.
      c. Locations of light fixtures and sprinkler heads.
      d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      e. Equipment connections and support details.
      f. Exterior wall and foundation penetrations.
      g. Routing of storm and sanitary sewer piping.
      h. Fire-rated wall and floor penetrations.
      i. Sizes and location of required concrete pads and bases.
      j. Valve stem movement.
      k. Structural floor, wall and roof opening sizes and details.
   2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
   3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

H. Sequence of Coordination
   1. Below is hierarchy of model elements and the sequencing by which the models will be coordinated:
      a. Structural and Architectural model
      b. Miscellaneous steel
      c. Perform preliminary space allocation
      d. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
      e. Main and medium pressure ducts from the shaft out
      f. Main graded plumbing lines and vents
      g. Sprinkler mains and branches
      h. Cold and hot water mains and branches
      i. Lighting fixtures and plumbing fixtures
      j. Smaller sized ducts and flex ducts
      k. Smaller size cold water and hot water piping, flex ducts, etc.

I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

END OF SECTION

SECTION 26 03 13

ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

B. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The contractor shall allow the Owner 2 weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

C. The contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

1.2 RELATED SECTIONS

A. Section 01120 - Alteration Project Procedures.

B. Section 02072 - Minor Demolition for Remodeling.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual Sections.

B. Include in the contract price all rerouting of existing conduits, wiring, outlet boxes, fixtures, etc., and the reconnecting of existing fixtures as necessitated by field conditions to allow the installation of the new systems. Furnish all temporary conduit, wiring, boxes, etc., as required to maintain lighting and power service for the existing areas with a minimum of interruption. Remove wire and conduit back to nearest accessible active junction box and extend to existing homeruns as required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements are as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner and Telephone Utility Company at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

G. Existing Public Address System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner and at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Section 01120, Section 02072, and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets, which are not removed.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I. Repair adjacent construction and finishes damaged during demolition and extension work.

J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

L. Where existing construction is removed to provide working and extension access to existing utilities, contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

M. Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

N. During the construction and remodeling, portions of the project shall remain in service. Construction equipment, materials, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building.

O. Certain work during the demolition phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner`s Representative at least 72 hours in advance.

P. All existing lighting fixtures, switches, outlets, speakers, materials, equipment and appurtenances not included in the remodel or alteration areas are to remain in place and shall remain in service.

Q. Electrical equipment, outlets, speakers, circuits to mechanical and building systems equipment, etc., which are to remain but which are served by conduit and/or circuiting that is disturbed by the remodeling work, shall be reconnected in such as manner as to leave it in proper operating condition.

R. Existing branch circuit wiring which is to be removed, shall be pulled from the raceways and the empty conduit shall be removed to a point of permanent concealment.

S. Within the remodeled or alteration areas where existing walls are being removed, all existing lighting fixtures, switches, receptacles, other materials and equipment and their appurtenances shall be removed, where required by the remodel work either shown or specified.

T. New circuiting indicated to be connected to existing panels shall be connected to "spares" and/or "released" breakers as applicable, or new breakers provided where space is available. Contractor shall verify the existing panel load and feeder capacity prior to adding any additional loads.

U. In all the remodeled areas where existing ceilings are being removed and reinstalled, all existing lighting fixtures, other ceiling mounted devices (i.e. smoked detectors, speakers, etc.) and their appurtenances shall be removed and reinstalled, unless otherwise shown or specified. This also applies to new ceiling installations.

V. Existing lighting fixtures shown to be removed and indicated to be reused, shall be cleaned, repaired, and provided with new accessories as required for the proper operation in their new locations. Provide new lamps and ballast as required.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Section 01120.

3.6 REMOVAL OF MATERIALS

A. The contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor`s responsibility and shall be repaired or replaced by the contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

END OF SECTION

SECTION 26 05 19

WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.1 SCOPE

A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.
1. Wiring for lighting, dimming controls and power.
2. Automatic Control Wiring.
3. Connection of equipment shown.
4. Fire Alarm System.
5. Voice Communications and Sound System.
6. Mineral Insulated Cable (MI)

C. WORK SPECIFIED ELSEWHERE:
1. Heating, ventilating, and air conditioning equipment.
2. Structured cabling system.
3. Coaxial cables

1.2 REFERENCE STANDARDS

A. UL 83 - Thermoplastic-Insulated Wires and Cables

B. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire

C. NFPA 70 - National Electrical Code

D. All wire cable and connectors shall be UL approved.

E. NEMA

F. NEMA Bulletin 119

1.3 ACCEPTABLE MANUFACTURERS

A. 600 VOLT WIRE AND CABLE
1. Southwire
2. Encore
3. Cerro

B. 300 VOLT WIRE AND CABLE
1. Westpenn
2. Beldon
3. Alpha
4. Tappan - Southwire

C. FLEXIBLE CABLE SYSTEMS
1. AFC Modular Cable Systems
2. Kaf-Tech

D. CONNECTORS
1. Ilsco
2. Cooper

3. AMP - TYCO
4. Burndy
5. Ideal
6. 3M
7. O.Z. Gedney
8. Thomas & Betts
9. Buchanan

1.4 SUBMITTALS

A. Shop drawings shall include, but not limited to:
1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 WIRING

A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B. WIRE MATERIAL: Conductors shall be soft drawn, annealed copper. Aluminum wiring is not acceptable unless otherwise noted on drawings.

C. TYPES:
1. Provide type “THHN/THWN-2” insulation for all buried feeders and service entrance conductors.
2. Provide type “THHN/THWN-2” insulation for all branch circuits and above grade feeders.
3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.
4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fixture bodies.
5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.
6. All dimming conductors shall be 300 volt, 75 C plenum rated. Dimming conductors shall be solid. Stranded conductors are not acceptable.

D. CONDUCTOR SIZES
1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.
2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.
3. Minimum wire shall be 12 AWG, unless otherwise shown on Drawings or required by Code.
4. Minimum wire size for 0-10v dimming controls shall be 18 AWG for conductors not exceeding 300 feet circuit length (one-way) and 16 AWG for those exceeding 300 feet (one-way).

E. COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:

<u>120/208 Volt</u>
Neutral: White
Phase A: Black
Phase B: Red
Phase C: Blue
Ground: Green

<u>277/480 Volt</u>
Neutral: Gray
Phase A: Brown

Phase B: Purple
Phase C: Yellow
Ground: Green

120/240 Volt
Neutral: White
Phase A: Black
Phase B: Orange
Phase C: Blue
Ground: Green

0-10 Volt dimming conductors
Purple (source)
Pink (common)

2.2 GROUNDING

A. Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with NFPA 70.

PART 3 - EXECUTION

3.1 WIRE

A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized twist on wire nuts. “Wago” push-in connectors are not acceptable.

D. All stranded conductors shall be furnished with lugs or connectors.

E. Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F. “Sta-Cons” shall be used to terminate stranded conductors on all switches and receptacles.

G. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

H. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

I. Route conductors for 480Y/277 systems in a separate raceway. Do not combine with 208Y/120 volt or 120/240 volt systems.

J. Emergency circuits shall not be routed with normal conductors.

3.2 BALANCING SYSTEM

A. The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.3 LOW VOLTAGE WIRING

A. Low voltage wiring, including dimming conductors, shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B. Low voltage wiring shall be routed in separate raceways from power wiring systems.

C. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.

E. Provide a junction box to make up all joints and splices.

F. Provide dimming conductors for all lighting circuits located in spaces with dimmer switches and theatrical lighting as indicated on the drawings and as specified.

3.4 CABLE SUPPORTS

A. Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

3.5 DEFECTS

A. Defects shall include, but are not to limited to, the following:
1. Tripping circuit breakers under normal operation.
2. Improperly connected equipment.
3. Damaged, torn, or skinned insulation.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:
1. Electrical.
2. Basic materials and methods.

B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.3 STANDARDS

A. National Electrical Code (NFPA-70)

B. Local municipal and State codes that have jurisdiction.

C. NECA

1.4 ACCEPTABLE MANUFACTURES

A. Provide grounding products manufactured by Copperweld and Cadweld.

1.5 SUBMITTALS

A. Shop drawings shall include, but not limited to the following:
1. Cut sheets of ground rods, clamps and connectors.
2. Grounding system diagram.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all materials required to construct a complete grounded electrical system.

B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.

C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.

B. SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of each switchboard. Route a separate grounding electrode conductor in conduit from each main gutter to the ground rod grid, incoming cold water piping system, and to the "lightning protection system" (250 - 106 of NEC) under ground bonding loop. Provide a bonding jumper around water meter. The grounding electrode conductor shall be stranded copper, 98% conductivity and shall be run continuous without splices or joints and installed at least 12" below grade.

C. BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

D. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

E. GROUNDING SEPARATELY DERIVED ALTERNATING CURRENT SYSTEM
1. TRANSFORMERS: The center point (neutral) of each wye connected transformer shall be bonded to the case and the grounding electrode conductor shall be connected to the grounded conductor (neutral).
2. STANDBY EMERGENCY GENERATOR: The generator neutral shall be bonded to the generator when a 4-pole switched neutral automatic transfer switch is specified.

F. GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

G. CONDUIT GROUNDING BUSHING: Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

H. MOTORS: The frame of all motors shall be grounded.

I. SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800-40(d) and 820-40(d) of the NEC.

J. REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC and shown on drawings.

K. LIGHTING FIXTURES: Flexible fixture whips containing a green grounding conductor shall be used to connect light fixtures. Flexible fixture whips shall not exceed ten feet.

L. RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.2 TESTING

A. Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 Ohms. Provide additional electrodes as required (refer to 250-84 and 250-56 of the most current edition NEC). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION

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SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 SCOPE

A. Provide electrical raceways and fittings as shown, scheduled and specified.

B. The types of raceways and fittings required are as follows:
1. Rigid hot-dipped galvanized steel conduit (GRC) (RMC)
2. Intermediate hot-dipped galvanized steel conduit (IMC)
3. Electrical metallic tubing (EMT)
4. PVC (Sch. 40 & 80)
5. Flexible metal conduit (FMC)
6. Liquid-tight flexible metal conduit (LFMC)
7. PVC coated rigid galvanized steel conduit (GRCC)
8. Rigid Aluminum Conduit (RAC)

1.2 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

F. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

G. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

H. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

I. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

J. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

K. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

L. NEMA FB-1

M. NEMA TC3

1.3 ACCEPTABLE MANUFACTURERS

A. Raceways
1. Allied
2. Republic

3. Prime Conduit (Carlon)
4. Wheatland Tube
5. Cantex
6. Western Tube
7. Robroy Industries

B. Fittings
1. Appleton
2. Crouse Hinds
3. Steel City
4. O.Z. Gedney
5. Carlon
6. Raco, Inc.
7. Bridgeport

C. Boxes
1. RACO
2. Thomas and Betts
3. EATON
4. Crouse-Hinds
5. Appleton

D. Surface
1. Hubbell
2. Wiremold

1.4 SUBMITTALS

A. Product data shall include but not be limited to:
1. Cutsheets for raceways, fitting, solvents, primers, etc.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A. NFPA 70

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Rigid Galvanized Steel Conduit (GRC/RMC)
1. Construction, Materials, Codes, Standards:
a. Article 344 - NFPA 70.
b. Hot-dip galvanized rigid steel conduit, galvanized after fabrication. Products shall comply with UL 6 and ANSI C80.1. All threads shall be galvanized after cutting. A uniform zinc coating shall be applied to the inner and outer walls.
c. Fittings shall be threaded and shipped with thread protectors. Set Screw are not acceptable. Die Cast Fittings are not acceptable.
2. Permitted for use in the following locations:
a. Outdoor or Exterior (Exposed)
b. Indoors, Conditioned Spaces
c. Unconditioned Spaces
d. Underslab (Void Form Slab): where not in contact with earth – only permitted where indicated on plan.
e. Underslab (Suspended Slab): Permitted – only where indicated on plan.
3. Prohibited Locations: Underground, Corrosive environments, Underslab (Slab on Grade), Foundation penetrations.
4. Specific Uses: Exposed Exterior installations, where within or attached to masonry or concrete, where subject to damage.

B. Intermediate Metal Conduit (IMC)
   1. Construction, Materials, Codes, Standards:
      a. Article 342 - NFPA 70.
      b. Conduit shall be similar to rigid steel conduit except thinner wall.
      c. Fittings shall be threaded hot-dipped galvanized and shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable
      d. Products shall comply with UL 1242.
   2. Permitted for use in the following locations:
      a. Outdoor or Exterior (Exposed)
      b. Indoors, Conditioned Spaces
      c. Unconditioned Spaces
      d. Underslab (Void Form Slab): not in contact with earth only as indicated on plan.
      e. Underslab (Suspended Slab): only where indicated on plan.
   3. Prohibited Locations: Corrosive Environment, Underground, Underslab (Slab on Grade), Foundation Penetrations
   4. Specific Uses: Exposed exterior locations, Rooftops exposed to sunlight

C. Electrical Metallic Tubing (EMT)
   1. Construction, Materials, Codes, Standards:
      a. Article 358 - NFPA 70.
      b. EMT shall be made of hot-dip galvanized strip steel. The interior shall be coated with a corrosion-resistant lubricant for ease of wiring pulling.
      c. Shall utilize steel insulated throat, set-screw connectors and steel set-screw couplings in all indoor conditioned spaces.
      d. Shall utilize steel insulated throat, threadless, watertight compression type connectors and steel threadless watertight compression type coupling in all non-conditioned spaces and in grout filled CMU walls.
      e. Products shall comply with UL 797 and ANSI C80.3.
   2. Permitted for use in the following locations:
      a. Indoors, Conditioned Spaces
      b. Unconditioned Spaces
   3. Prohibited Locations: Corrosive Environment, Underground, Underslab (all types), Wet or Damp Locations, Exteriors, Within Concrete, foundation penetrations.
   4. Specific Uses: Primary use conduit for indoor spaces, where conditioned. Unconditioned locations shall require use of insulated throat water tight fittings.

D. Rigid Nonmetallic Conduit (PVC Schedule 40 & 80)
   1. Construction, Materials, Codes, Standards:
      a. Article 352 and 300.6 - NFPA 70.
      b. Conduit shall be schedule 40 or 80 polyvinyl chloride (PVC), UV stabilized, rated for 90°C conductors.
      c. Fittings shall be solvent weld socket type.
      d. Products shall comply with UL 651.
   2. Permitted for use in the following locations:
      a. Underground (Earth, outside foundation perimeter)
      b. Underslab (Slab on Grade): only where indicated on plan.
      c. Under Driveways, roadways, or vehicular crossings, and where required by Utility Company: PVC Schedule 80
         1) PVC Schedule 40 allowed where concrete encased.
   3. Prohibited Locations: return air Plenums, interstitial spaces, Outdoor or Exterior (Exposed), Unconditioned spaces, corrosive environments, underslab (suspended or void form), foundation penetrations.
   4. Specific Uses: For use underground or underslab (Slab on grade). Underground use is approved for all locations where transiting a project site, not underneath any foundation. For locations under the footprint of building/foundation, use only authorized where indicated on drawings.

E. Flexible Metal Conduit (FMC/Greenfield)
   1. Construction, Materials, Codes, Standards:
      a. Article 348 - NFPA 70.

b. Spirally wound continuously interlocked zinc coated strip steel.
c. Fittings shall be one screw for smaller than 1-1/2-inch, two screw for 1-1/2-inch and larger, double clamp steel or malleable iron, either cadmium plated or hot-dip galvanized.
d. Products shall comply with UL 360.

2. Permitted for use in the following locations:
   a. Indoors, Conditioned Spaces.
3. Prohibited Locations: outdoors/Exterior, unconditioned spaces, Corrosive, Wet, Concrete, underslab(all types), underground, foundation penetrations.
4. Specific Uses and Applications: For use in connection to rotating equipment within conditioned spaces, including plenums. Also permitted for use with empty raceways in walls for use with Low Voltage, AV, telecom cabling.

F. Liquid-Tight Flexible Steel Conduit (LFMC/Seal Tite)
1. Construction, Materials, Codes, Standards
   a. Article 350 - NFPA 70.
   b. Spirally wound continuously interlocked zinc coated strip steel with a UV stabilized polyvinyl chloride (PVC) outer jacket bonded to the conduit.
   c. Fittings shall be compression type, malleable iron, with insulated throat, either cadmium plated or hot-dip galvanized. Plastic is not acceptable.
2. Permitted for use in the following locations:
   a. Outdoor or Exterior (Exposed)
   b. Indoors, Conditioned Spaces
   c. Unconditioned Spaces
3. Prohibited Locations: Concrete, corrosive, underground, underslab (all types), foundation penetrations.
4. Specific Uses and Applications: Primary use is connection to rotating equipment at unconditioned spaces. Transformer Primaries and Secondaries (excluding service transformer).

G. PVC Coated Rigid Galvanized Steel Conduit (GRCC/Plastibond)
1. Construction, Materials, Codes, Standards:
   a. Article 344 and 300.6 - NFPA 70.
   b. Conduit shall be same as rigid metal conduit with a factory-applied 40-mil-thick covering of polyvinyl chloride (PVC) bonded to the metal, coated inside and outside.
2. Permitted for use in the following locations:
   a. Outdoor or Exterior (Exposed): except for stub-ups and penetrations.
   b. Corrosive Environment: required throughout
      1) Where corrosive environments exist, such as pools, pool pump room, corrosive chemical storage, GRCC shall be provided throughout, up to the point of sealed penetration into a non-corrosive environment.
   c. Underground (Earth, outside foundation perimeter): Required at bends of 15° or greater, Penetrations through concrete, Stub-ups through foundation or grade at concrete.
   d. Foundation Penetrations
3. Prohibited Locations: extended runs exposed to sunlight, Plenums, Underslab except for penetrations (all foundation types).
4. Specific Uses: For use at Cooling Towers, Pools, Pool Decks, Pool pump rooms, chemical storage, corrosive environments.

H. Rigid Aluminum Conduit (RAC)
1. Construction, Materials, Codes, Standards:
   a. Article 344 - NFPA 70.
   b. Rigid aluminum (alloy 6063-T1) conduit shall be manufactured using 6063 Alloy in temper designation T-1.
   c. Fittings for rigid aluminum conduit shall be threaded aluminum shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable
   d. Products shall comply with UL 6A and ANSI C80.5.
2. Permitted for use in the following locations:
   a. Outdoor or Exterior (Exposed)
   b. Indoors, Conditioned Spaces
   c. Unconditioned Spaces
3. Prohibited Locations: Corrosive environments, underground, within concrete, underslab (all types), foundation penetrations.
4. Specific Uses and Applications: Exposed Exterior such as rooftops or canopies.

2.2 PULL BOXES

A. Exterior in-ground pull boxes shall be concrete or polymer as manufactured by Brooks, Dalworth, Hubbell Quazite, or approved equivalent. Covers shall include identification of systems contained.

B. Where located in Roadways, Parking Lots, or Traffic zones, Pullboxes shall be rated to accept a minimum 22,500 lb. load per ANSI/SCTE 77.

C. All Pullboxes shall be sized based on NEC wire-bending requirements at each individual location.

D. Covers shall include identification of systems contained, such as:
1. Electrical
2. Telecom
3. Communications
4. Others, as required.

E. Pull boxes in pole bases shall be as manufactured by Carlon.

F. Pullboxes shall be provided in all raceway systems upon exceeding the following conditions:
1. The equivalent of 270° in conduit bends, or after (3) 90° bends.
2. Any 400ft of linear conduit or duct bank continuous segments.
3. Where required to make transitions to prevent the damaging of conductor insulation.

2.3 WIREWAYS

A. Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

B. The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrode position paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

2.4 BUSHINGS

A. Provide nylon bushing on end of all low voltage cabling system conduits (sleeves, rough-ins, etc.).

B. Provide Grounding Bushing as required in 26 05 26 - Grounding.

PART 3 - EXECUTION

3.1 PROVIDE CONDUIT AS FOLLOWS:

A. GENERAL: The Drawings are diagrammatic and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

B. Raceways shall not be routed below or within slab-on-grade, foundations, or below grade of suspended slab structures, unless specifically noted or indicated otherwise on plan.

C. EMT in sizes up to 4 inches when concealed or not exposed to damage and located indoors only. (EMT is not acceptable in wet and damp location.)

D. MINIMUM SIZE: 3/4 inch.

E. Flexible conduit of any type shall not be used except for connections to rotating or vibrating equipment, or where use for low voltage raceways. All conduit shall be provided as a rigid type conduit for homeruns, runs between termination boxes, outlets, etc.

F. Fixture whips: Refer to 26 51 19 for additional information.

G. Of such size, and so installed that conductors may be drawn in without injury or excessive strain.

H. Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.

I. Have Red seal type VCC or approved equal cable supports in risers, as required by NFPA 70.

J. Have ends reamed after cutting and application of die.

K. Keep conduit corked and dry during construction and swab out before conductors are pulled.

L. Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.

M. Have O.Z. Gedney or approved equal expansion fittings where crossing building expansion joints.

N. Fixtures in finished areas having suspended acoustical ceilings shall be connected to outlet boxes of lighting grid by flexible metal conduit; length not to exceed ten feet (six feet if using 3/8” manufactured fixture “whips”).

O. Outlet boxes in partitions shall never be set back-to-back. They shall be offset to prevent undue noise transmission from room to room.

P. Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.

Q. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of conduits. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel with a minimum thickness of 1.07MM and set to extend 4” above slab.

R. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty. All fire rating material shall be installed in accordance with manufacturer`s printed instructions.

S. All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.

T. Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.

U. All conduit shall be securely fastened and supported using hot galvanized malleable iron one-hole pipe straps, clamps, hanger or other means approved by the engineer. Supports shall be as required per NEC. Tie wire shall not be used as support or securing means. Support conduit independently of ceiling hanger wire. Use all thread rods to support outlet boxes, junction boxes and conduit.

V. Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

W. All new outlets shall be flush mounted. In remodeled areas where wall construction prohibits flush mounting, provide Hubbell 2400 series, unless noted otherwise. Verify exact location and routing with architect before installation.

X. Contractor shall not penetrate waterproof barriers without using proper fitting to maintain barriers. This shall include exterior walls and slabs. Coordinate with Architect for proper methods.

3.2 CONDUIT ROUTING

A. Conduit shall be concealed and by using the shortest practicable route between outlets, including where located on CMU walls.

B. Conduit may be exposed in electrical and mechanical rooms, and central plants, or other industrial type facilities such as warehouses or production plants.

C. Install risers, drops, offsets to avoid ductwork and structural components. Ductwork and structural systems shall take precedence to conduit.

D. Any exposed and visible conduit shall be parallel and perpendicular based on the lines of the building (such as ceiling lines, wall blocking lines, or architectural feature lines) using structural systems to conceal conduit visibility at all opportunities.

E. Concealed conduit shall be run in as direct manner as possible, using long bends. All bend radii shall be 12x conduit diameter. Condulets in lieu of elbows where ease of installation and appearance warrant their use – confirmation with architect is required for this use.

F. Conduit shall be continuous, with no more than (4) quarter bends between terminals, cabinets, boxes, or pullboxes is acceptable. Contractor is expected to provide wireway or boxes at appropriate intervals, in accordance with NFPA 70 for wire bending space. All conduit shall be electrically continuous throughout, including across boxes and cabinets. Terminals of all conduit shall be provided with double lock nuts and bushing, or terminated on conduit hubs. Use of Running Threads prohibited.

3.3 CONDUIT CORROSION PROTECTION

A. Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.

B. At locations where metallic conduits pass through slabs on grade or transitions below grade, PVC coated rigid galvanized conduit shall be used.

C. Conduit installed in the air gap between the water-resistant barrier and finish brick shall not exceed 2-ft. in length.

3.4 EXPANSION JOINTS

A. Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

3.5 OUTLET AND JUNCTION BOXES

A. Provide an approved galvanized outlet box with adequate volume for number of conductors installed.

B. Provide standard galvanized switch boxes of the required number of gangs. Switch boxes where conduit is exposed shall be handy boxes or approved equal.

C. Outlet boxes for receptacles shall be similar to Universal 52151 with suitable raised cover. Receptacle boxes where conduit is exposed shall be handy boxes or approved equal.

D. Weatherproof boxes shall be FS or FD. Provide these boxes in all non-conditioned areas, exterior areas and natatoriums.

E. Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.

F. See notes and details on Drawings for special box requirements.

G. Provide junction boxes required to facilitate installation of the various conduit systems. Provide support boxes required for risers, each complete with approved cable supports as described elsewhere in this Division.

H. Outlet boxes for drywall shall be standard galvanized 4" square boxes with the appropriate device cover. Secure all outlet boxes with a backing brace connected to two adjacent studs. Mounting brackets with a single ear to rest against the backing sheet rock are not acceptable.

I. Provide floor outlet fittings for telephone to match fittings for duplex floor receptacles.

J. Provide 3-1/2” deep gangable masonry boxes in all masonry wall (CMU). Steel City GW-135-G or approved equal.

K. Provide shallow 4”x4” boxes in all demountable partitions.

L. Metallic boxes located in fire rated walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when “ Wall Opening Protective Materials” (CLIV) are installed according to the requirements of their Classification. Metallic boxes shall not be installed on opposite side of walls or partitions of staggered stud construction unless “Wall Opening Protective Materials” are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

M. Junction, pull boxes, condulets, gutters, disconnects, contactors, etc., above 2-foot x 2-foot grid ceilings shall be mounted within 18-inches of ceiling grid. Above 2-foot x 4-foot grid ceiling they shall be mounted within 30-inches of ceiling grid. All junction box, pull box, gutter openings shall be side or bottom accessible.

N. Junction boxes are prohibited above drywall or plaster ceilings except for lighting; and those must be mounted directly over light fixture opening. Route power, PA, fire alarm conduits to nearest lay-in ceiling.

3.6 THRU-WALL SEALS

A. Provide O.Z. Gedney “Thru-wall” seals for all conduits passing through concrete structure below grade, above grade, and floor penetrations below grade. These prevent moisture from entering the building.

B. Straight sleeves are not acceptable.

3.7 PULL BOXES

A. Interior Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code. Size pull boxes per Article 314.28 - NFPA 70.

B. Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

C. Exterior in-ground pull boxes shall have open bottoms with sand and rock beds below box for drainage of water. Provide closed bottom boxes where specified. Closed bottom boxes shall be provided with sumps for portable pump to allow for extracting water. Refer to details on the drawings.

D. Pull boxes mounted in pole bases shall be coordinated with the pour of the pole base and shall be flush with finished footing.

3.8 WIREWAYS

A. Wireways shall be installed as indicated or required and locations shall be coordinated with architect.

B. Wiring in wireways shall be neatly bundled, tied and suitably tagged.

3.9 UNDERGROUND DUCTBANK SYSTEM

A. DUCT SYSTEM
1. The duct system shall consist of Schedule 40 PVC or type 1-EB PVC conduits encased in red concrete as detailed on the drawings. Use rigid conduit for stub-ups and the last ten feet at the end of each ductbank. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet and shall be free from either horizontal or vertical waves. Duct lines shall be straight unless otherwise noted on the drawings. Duct lines shall be installed so that the top of concrete in encased duct lines is not less than 24 inches below finished grade or finished paving at any point. Changes in direction or runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 5 feet. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof using five degree angle couplings. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits. Particular care shall be taken to keep the conduits clean of concrete, dirt, and any other substance during the course of construction.
2. Each single conduit of the duct bank shall be completely encased in steel reinforced concrete as indicated. The thickness of concrete encasement indicated is the minimum thickness, and may be increased to fit the actual shape of trench.
3. Concrete for duct bank envelopes shall be standard 2000 psi concrete mix as described in Division 03, and be colored deep red for permanent marking of underground electrical work. The concrete red pigment shall be pure inorganic natural metallic base pigment, approved by the Engineer before use. Organic pigments will not be permitted. The approved pigments shall be mixed four pounds per yard of cement.
   a. Envelopes may be poured directly against sides of trenches if the "cut" is clean, even and free of loose material. All loose dirt and extraneous material shall be removed from the trenches before and during the pouring of concrete to ensure sound envelopes. Concrete shall be carefully spaded during pouring to eliminate all voids under and between the conduit and honeycombing of the exterior surfaces. Power driven tampers of agitators shall not be used, unless specifically designed for the application, in order to ensure that the water-tightness of the conduits is not destroyed.
   b. Generally, each run of envelopes shall be poured in one continuous operation. Where more than one pour is necessary, each pour shall terminate in a vertical plane. Partial pours shall not terminate in horizontal or angular planes.

B. For normal underground installation see Section 26 02 00, paragraph 3.1 for Excavating and Backfilling.

END OF SECTION

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SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 RELATED SECTIONS

A. Section 01 91 00 - General Commissioning Requirements

B. Section 23 09 63 - Energy Management and Control System (EMCS)

1.3 SUMMARY

A. The commissioning of the lighting system and associated controls as well as the service and distribution equipment shall be performed by an impartial technical firm hired by the owner or shall be performed by the installing contractor if the owner has not hired a commissioning firm. The commissioning provider shall be certified under one or more of the following certifications:
   1. CxA - Certified Commissioning Authority - ACG
   2. CBCP - Certified Building Commissioning Professional - AEE
   3. CCP - Certified Commissioning Professional - BCA
   4. CPMP - Certified Process Management Professional - ASHRAE
   5. BSC - Building System Commissioning Certification - NEBB

B. The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.4 RESPONSIBILITIES

A. Contractor: Responsibilities of the Contractor as relate to Commissioning Process include, but are not limited to the following:
   1. Facilitate coordination of Commissioning work by Commissioning authority.
   2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
   3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
   4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.
   5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.
   6. Provide As-built drawings and documentation to facilitate Testing.
   7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.
   8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.
   9. Install systems and equipment in strict conformance with project specifications, manufacturer’s recommended installation procedures, and Pre-Functional Checklists.
   10. Provide data concerning performance, installation, and start-up of systems.
   11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.
    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.
13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.
14. Provide qualified personnel to assist and participate in Commissioning.
15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.
16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.
17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.
18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.
19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.
20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.
21. Coordinate and provide training of Owner's personnel.
22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority's comments.
23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B. Subcontractors and vendors shall prepare and submit to Commissioning Agent proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority.

C. Electrical contractor shall provide a letter certifying the installed lighting controls meet documented performance criteria specified in the commissioning plan within 90 days of substantial completion.

1.5 COMMISSIONING PLAN

A. Commissioning Process tasks and activities:
1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.
2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.
3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.
4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications.
5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.

6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.
7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B. Electrical System Equipment to be tested
1. Occupancy sensors.
2. Time switch controls
3. Daylighting controls.
4. Electrical Service and Distribution System.

C. Testing functions and conditions
1. Daylighting control devices
a. Verify the devices have been calibrated, properly located and adjusted.
b. Loads adjust to light level set points in response to daylight.
c. Location of calibration equipment is accessible to authorized personnel only.
2. Time switches
a. Verify schedule, time, date and programming is accurate.
b. Verify override time limit is set, battery is installed and switch operates the lights that are specified in the design documents.
c. All specified lights can be turned on and off by area control switch.
d. Manual override switch allows only the lights in the space where the switch is located turn on or remain on until next scheduled shut off.
3. Occupant sensors:
a. Certify the sensor has been located and aimed in accordance with manufacturer recommendations.
b. For projects with fewer than seven sensors, each sensor shall be tested.
c. Fore projects with more than seven occupant sensors, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each combination are provided not less than 10 percent shall be tested.
d. Verify correct operation of status indicators.
e. Controlled lights turn off or down to the permitted level with in the required time.
f. For auto-on sensor, the lights turn-on to the permitted level when an occupant enters space.
g. Verify the lights are not incorrectly turned-on by movement in adjacent areas or by HVAC operation.
4. Electrical Service and Distribution System
a. Document the ground resistance testing performed by contractors.
b. Document electrical subcontractor has adjusted breakers to setting recommended by coordination study.
c. Document that any required infrared studies are performed.
d. Document testing of transformer insulation and voltage drop.
e. Document any other testing requirements have been fulfilled as required within specifications.

D. Performance criteria
1. Daylighting controls shall maintain specified light levels within 5% of design.
2. All time switches shall be accurate to time on cellular network devices.

PART 2 - PRODUCTS

2.1 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.1 GENERAL

A. This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B. Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C. Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.2 WORK PRIOR TO COMMISSIONING

A. Complete all phases of the work so the systems can be started, adjusted, balanced and otherwise tested.

B. See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C. Assist Commissioning Agent with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D. Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E. A minimum of seven (7) days prior to date of system startup, submit to Commissioning Agent for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.3 PARTICIPATION IN COMMISSIONING

A. Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B. Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.4 WORK TO RESOLVE DEFICIENCIES

A. Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor’s responsibility.

3.5 PRE-FUNCTIONAL CHECKLISTS (PFC)

A. Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division’s systems.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

3.6 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B. Refer to commissioning plan for detailed list of equipment to be commissioned.

C. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

D. Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E. Sampling
1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.
2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.
3. A common sampling strategy is the “xx% Sampling - yy% Failure Rule”, defined by the following example.
   a. xx = the percent of the group of identical equipment to be included in each sample.
   b. yy = the percent of the sample that if failing, will require another sample to be tested.
   c. The example below describes a 20% Sampling - 10% Failure Rule.
   d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
   e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).
   f. If 10% of the units in the second sample fail, test all remaining units in the whole group.
   g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

F. Re-Testing And Failure To Remedy Deficiencies
1. Despite Contractor’s best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is Contractor’s responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is Contractor’s responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
   a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor’s control to resolve expeditiously.
   b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor’s request.
   a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA’s expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

G. Deferred Testing
1. "Seasonal Commissioning” pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.

3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.
5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.7 TRAINING

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C. The training agenda (plan) shall include, at a minimum, the following elements:
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.

D. Commissioning Agent shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning Agent with training plan two weeks before planned training.

3.8 OPERATIONS & MAINTENANCE MANUALS

A. The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B. Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C. Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority's copy of O&M manuals shall be submitted through Architect.

D. Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.9 DOCUMENTATION

A. Commissioning authority shall provide documentation of process as follows:
1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.
2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION

SECTION 26 28 16

SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. Provide safety and disconnect switches as shown, scheduled and as specified herein.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.
   1. NEMA KS1 - Enclosed switches
   2. Federal specification W-S-865C-Heavy duty switches

B. Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
   1. General Electric Company/ABB
   2. Square D Company
   3. Siemens
   4. Eaton

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
   1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
   1. National Electrical Code.
   2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

2.2 MATERIALS AND COMPONENTS

A. Switch Interior
   1. All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60ºC and 75ºC copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B. Switch Mechanism

1. Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C. Neutral
1. Provide a solid neutral with the safety switch where a neutral is present in the circuit.

D. Ratings
1. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips or adjusted for Class J fuses. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E. Enclosures
1. Indoor switches shall be furnished in NEMA 1 enclosures.
2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.
3. Switches installed in wet areas such as cooling tower areas shall be NEMA 4X stainless steel or fiberglass reinforced polyester.
4. Switches installed in kitchens shall be stainless steel.
5. Switches installed in areas of a corrosive nature and subjected to salt air shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

F. Electrical Interlock Contacts
1. Provide electrical interlock contacts on all disconnect switches serving motors in which remote VFDs are serving the motor. Provide conductors from contacts to the safe circuit inside the VFD. De-energizing the disconnect switch shall signal VFD to stop.

G. Service Entrance
1. Switch shall be suitable for use as service entrance equipment when installed in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.1 GENERAL

A. Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer’s written instructions, NEC and recognized industry practices.

B. Location: Install switches within sight of controllers.

C. Hubs: Provide bolt-on hubs for rainproof or wet area applications.

3.2 IDENTIFICATION

A. Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION

SECTION 26 29 26

MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.

B. The types of miscellaneous control devices and wiring include but not limited to the following.
1. Contactors
2. Relays
3. Photocells
4. Time switches
5. Relay Panels
6. Additional control wiring and safety devices as shown and specified
7. Connect power from fire alarm relays to starters to shut down air handling units
8. Elevator power module switches
9. Motorized Dampers
10. Smoke Dampers and Combination Fire/Smoke Dampers

C. WORK SPECIFIED ELSEWHERE:
1. Various control devices, of an electrical nature, for the safe operation and temperature control of the heating, ventilating, air conditioning and plumbing systems provided under Division 22 and Division 23.
2. All control wiring and conduit shall be furnished under Division 23. All power wiring 120 volt or larger shall be provided by Division 26.
3. Refer to building controls specification, Division 23 for scope of work required to be performed by Division 26 (electrical contractor).
4. Specification 26 05 19 - Wire, Cable and Related Materials.

1.3 REFERENCE STANDARDS

A. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

E. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

F. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

G. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
1. NFPA 70
2. Local municipal or state codes that have jurisdiction.
3. UL 916
4. UL 924

1.5 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:
1. LIGHTING CONTACTORS AND RELAYS
a. General Electric Company/ABB
b. Square D Company
c. Automatic Switch Company
d. Eaton
e. Siemens
2. PHOTOCELLS AND TIME SWITCHES
a. Tork, Inc.
b. Intermatic time controls
3. RELAY PANELS
a. Wattstopper
1) LMCP
b. Cooper/Eaton
1) ControlKeeper
4. ELEVATOR POWER MODULE SWITCHES
a. Eaton-Bussmann

PART 2 - PRODUCTS

2.1 MATERIAL

A. GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.

B. CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system:
1. Rated at 600 volts, 60 hertz.
2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
4. The contactor shall have straight-through wiring with all terminals clearly marked.
5. The contactor shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA ICS 2-21 1B.
6. They shall be industrial-duty rated for applications to 600 volts maximum.
7. The contactor shall have provisions for factory or field addition of:
a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer.
10. Electrically Held Lighting - Contactor coils shall be continuously rated and encapsulated. Electrically held contactors are not to be used unless specifically shown on the plans.

11. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.
12. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.
13. Provide hand-off-automatic controls (H-O-A) for each lighting contactor.
14. Provide relays and contactors to shut down air handling units.

C. Photocells for Stand-alone controls (not part of relay panel controls): Provide a specification grade self-contained, weatherproof, photoelectric control that shall be mounted on an FS type weatherproof junction box. The photocell shall:
1. Switch "ON" at dusk and "OFF" at dawn.
2. Adjustable from 2 to 50 foot-candles.
3. Rated at 2,000 watts.
4. Use 1" diameter cadmium sulphide cell.
5. Have a 2-minute delay to prevent false switching.

D. TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.

E. Control wiring shall be not less than #14 AWG type THWN/THHN and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

F. Relay Panels
1. Rated 277V, 60Hz.
2. Panel operating voltage of 120-277V
3. Uses any of the following relays:
   a. Mechanically Latching Relays
   b. Multi-pole Relays
4. 15A, 20A, and 30A rated relays available
5. Basic Capabilities:
   a. 7-Day Clock
   b. Capable of being set for 7 different day types per week
   c. Includes automatic holiday shutoff feature
   d. Has program backup to restore operations after power failure
   e. Can be expanded to include override switches
   f. On-board programming and processing
6. Each individual relay can be individually or group programmable to operate based on user-provided parameters, manual switch operation, photocells and sensors, or automatic program routines.
7. Rated for minimum of 10 million operations.
8. Contains occupant warning features to flash relays prior to time-out to notify occupants of change of state.
9. Capable of interfacing with other systems via RS-232, RS-485, or Ethernet.
10. Capable of interfacing with occupancy sensors for zone control.
11. Capable of Switch-Masking or Lockout features for user-operated switches.
12. Provide Locking Hinged Enclosures as suitable for relay panel environment. At a minimum, all relay panels shall be NEMA 1, and may be included with the relay panel assembly from the manufacturer. Provide enclosures to house relay panels where NEMA 1 is insufficient, as follows:
   a. Outdoors and unconditioned spaces: NEMA 3R
   b. Central Plants, or any plant with process water systems: NEMA 4/12
   c. Outdoors, Within 50-miles of saltwater coastlines: NEMA 4X
13. Dimming Modules shall be furnished with each relay panel, where dimming is required, per plan.
14. Pushbutton switches manufactured as compatible with the relay panel to either be used as override switches, or general control switches.
15. Provide photocells for use by relay panels for exterior ambient light monitoring:
   a. 1 per relay panel, when relay panels are stand alone
   b. 1 per building, when relay panels are networked

G. Elevator Power Module Switches
1. NEMA 3R enclosure
2. Key to Test Switch

3. "ON" Pilot Light (Green, Red, or White)
4. Isolated Full Capacity Neutral Lug
5. 1P NC Mechanical Interlocked Auxiliary Contact (required for hydraulic elevators with automatic recall)
6. Fire Alarm Voltage Monitoring Relay (required to comply with NFPA 72)
7. Control Power Transformer with primary and secondary fuses
8. Isolation Fuses
9. Isolation Relays
10. 120 Volt Coil
11. Shunt trip Solenoid connected to the fire alarm panel
12. Class J Fuses
13. UL 98

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install miscellaneous electrical controls and wiring to provide a functioning system.

B. Install contactor and relays in electrical/mechanical rooms unless otherwise noted.

C. Install photocells on the roof unless otherwise directed by the architect. Coordinate any roof penetrations with all other trades and shield from other light sources. Install photocells high on North facing walls, or in accordance with manufacturer's installation instructions.

D. Provide miscellaneous connections including disconnect switches for signs and other furnished equipment as shown on the Drawings.

E. Provide NEMA 3R/4/4X/12 enclosures where located outside.

F. Provide low-voltage cabling between relay panels and all control devices. Cabling shall be furnished by contractor as required by panel manufacturer, including Cat5, Cat6, Belden, dimming pairs, or other as required by the manufacturer. Pre-terminated cabling by manufacturer is acceptable.

G. All Low-Voltage cabling, for all systems, shall be neatly routed using J-Hooks. Cabling is installed above a hard ceiling, conduit shall be used to traverse the hard-ceiling segments.

H. Install elevator power module switches in an elevator machine room, control room, machinery space, or control space in accordance with ASME A17.1. Other installation locations that are readily accessible to qualified persons such as electrical or mechanical rooms may be permissible in the event that machine roomless (MRL) elevators are provided with a control space of inadequate size to accommodate the power module switches.

3.2 DIVISION 22, 23, 27 AND 28 MISCELLANEOUS POWER AND CONTROLS

A. Install electrical devices not an integral part of system equipment providing conduit, boxes, fittings, wiring, circuit breakers, disconnecting means and other devices.

B. Contractor is responsible for providing all line voltage power to devices that require electrical power to operate. This shall include but not be limited to motorized dampers, smoke dampers, combination fire/smoke dampers, motorized gates, overhead rolling doors, and building control panels. Contractor shall terminate line voltage power to termination points. Contractor shall coordinate between all trades to determine sizing and quantities of line voltage circuits to adequately power and control devices. Provide circuits from nearest low voltage panel using spare circuits provided, if device requires power not already available or indicated.

C. Provide GFCI receptacle with weather proof cover within 25 feet of all heating, air conditioning and refrigeration equipment per NFPA 70.

3.3 OPERATIONS PERSONNEL TRAINING

A. All relay panels require manufacturer technician time to meet with owner, set programming conditions, time of day operations, and ensure owner-intended operations are met, based on whichever is most appropriate based on project size:
   1. 8-Hours per relay panel
   2. The amount of time required to successfully meet the criteria of this section and result in a fully working system, accepted by the Owner.

B. A one-time recommissioning site visit, 4 Hours in time, by a manufacturer technician anytime between 90 and 120 days of building occupancy to adjust and reprogram (as required) the system based on owner input. This meeting shall be scheduled by the manufacturer and can only be declined by the owner.

C. 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/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.

END OF SECTION

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SECTION 26 32 13.09

NATURAL GAS ENGINE-DRIVEN STANDBY GENERATING SYSTEM (60 KW) (ROBINSON)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. SCOPE
1. Provide a standby electric generating system manufactured by Cummins C80N6 series electric set rated for continuous standby service at [80kW, 93.8kVA] at 0.8 power factor, 3-phase, 480Y/277 volts, 60 cycle. The system shall be a package of new and current equipment consisting of:
   a. A natural gas engine driven electric plant in a (weather-protective housing) to provide emergency electric power.
   b. Automatic transfer switch(es) to provide automatic starting and stopping of the plant and switching of the emergency load.
   c. Mounted accessories as specified.
   d. Control wiring.
   e. Provide oversized alternator as specified.
   f. Load bank.
   g. Manual transfer switch and docking station.

1.2 PERMITS, TEST INSPECTIONS

A. This system shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has parts and service facilities locally available so that there is one source of supply and responsibility. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. The complete system shall bear a seal showing that it is prototype test supported.

1.3 REQUIREMENTS

A. Level 1 applications are legally required emergency systems.

B. The electric generating system must meet all requirements of NFPA 110 (latest edition) including design specifications, prototype tests, one-step full-load pickup, and installation acceptance. Engine-generator system to provide source of power for Level 1 applications.

1.4 STANDARDS

A. Equipment shall meet the latest versions of the following codes:
1. NFPA 30
2. NFPA 37
3. NFPA 70
4. NFPA 99
5. NFPA 101
6. NFPA 110
7. IEEE C62.41.1
8. IEEE 446
9. NEMA MG 1, ICS
10. ANSI
11. UL 1008
12. UL 2200

13. MIL-STD 461 C - Part 9, IEC 801.2, IEC 801.3, IEC 801.5, IEC 1000-4-2,3,6 - RFI and EMI Performance.

1.5 SUBMITTALS

A. Provide a specification compliance document noting any deviations to the specification. Document shall be a copy of the specification noting Comply, Deviate, or Exception to each section with detailed explanation for each deviation and exception.

B. Shop drawings shall include but not be limited to:
1. Catalog cut sheets with all equipment, accessories and devices including all ratings.
2. Interconnection wiring diagrams.
3. Complete bill of materials.
4. Certified performance tests.
5. Sizing report using manufacturer software confirming the engine and alternator complies with the size required to supply the connected load. Submit alternate generator if the proposed unit will not comply. The generator shall not exceed 85% of the rated load.

C. Operation and Maintenance Data
1. Submit under provisions of Division One.
2. Furnish three copies of the manuals and books listed below in substantial three-ring binders for each unit:
a. Operating Instructions: Describe and illustrate all switchgear controls and indicators and engine and general controls. Include instructions for operating transfer switch equipment under normal and emergency conditions when engine generator is running.
b. Parts Books: Illustrate and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).
c. Preventative Maintenance Instructions: Describe the daily, weekly, monthly, biannual and annual maintenance requirements and include a complete lubrication chart.
d. Routine Test Procedures: Describe procedures for engine, radiator, all electronic and electrical circuits, and the generator.
e. Troubleshooting Chart: Describe and list all troubles, probable causes, and suggested remedies.
f. Recommended Spare Parts List: List all consumables anticipated to be required during routine maintenance and testing. List special tools, maintenance materials and replacement parts.
g. Wiring Diagrams and Schematics: Show function of all electrical components.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One.

B. Accept units on site on skids. Inspect for damage.

C. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.7 ACCEPTABLE MANUFACTURERS

A. Provide products complying with these specifications and produced by the following:
1. Generator Manufacturer
a. Cummins
b. Kohler
c. Bluestar
2. Automatic Transfer Switches
a. ASCO
b. Cummins Power Generation

1.8 ACCEPTABLE SUPPLIERS

A. All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade power system products for a minimum of 15 years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall be authorized to perform warranty service on all products provided.

B. The supplier shall maintain a minimum of 6 factory trained and qualified field technicians within 50 mile of the job site, a proper supply of spare parts for the supplied equipment, a shop with overhaul capabilities; and be able to provide 24 hour, 7 days per week, 365 days per year field service capability.

PART 2 - PRODUCTS

2.1 ENGINE

A. The engine shall be radiator cooled, natural gas fueled, 4 cycle, 6 cylinder. It shall have a total piston displacement of not less than 359 cubic inches and develop not less than 100.3 brake horsepower at its operating speed. A radiator air discharge duct flange shall be provided for a connecting duct to allow all heated air and gases to be discharged out of the building, or enclosure, through one opening. The radiator cooling system shall be rated at 104 degrees F ambient against an external restriction of 0.5 inch water column. Engine cooling air requirements shall not exceed 5800 CFM.

B. The engine shall be of 1-piece cast alloy iron construction with cast alloy iron heads. Valves shall be overhead and free to rotate. Valves shall be hard chrome-cobalt alloy faced with replaceable valve seat inserts of solid chrome-cobalt alloy. The crankshaft shall be forged steel. Main bearings provided between all cylinders. The connecting rods shall be forged steel with connecting rod bearings. Provide full-flow, replaceable oil filter with bypass. Oil pressure gauge shall be included.

C. The engine shall be equipped with adjustable isochronous electronic governor with speed regulation 5.0 percent, no load to full load main output circuit breaker, fuel carburator system with automatic fuel shut-off and a reusable air element air cleaner and natural gas fuel train.

D. Provide a 12 volt electrical system and electric starter.

E. 120 VAC thermostatically controlled water jacket heater system (1500 watts) shall be provided. Contractor shall install normal power to the heater.

F. Provide the following safety shutdown fault devices:
1. Low oil pressure
2. Over-speed
3. Over-crank
4. High temperature (with low water level)

G. Provide the following alarms:
1. Low engine temperature (indicating jacket heater malfunction)
2. Marginally high engine temperature
3. Marginally low oil pressure
4. Flashing light for control switch in "Stop" position.

H. Generator main circuit breaker shall be UL listed, set-mounted, factory connected, molded case type with electronic trip unit. Submittals shall demonstrate that the circuit breaker provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. (Lugs on breaker shall match “ATS” lugs). Provide ground fault alarm for breakers rated 1000 amps and larger to comply with Article 700.6 (D) of the National Electrical Code

I. Provide output breaker for load bank.

2.2 ALTERNATOR

A. Rating 67 kW, 84 KVA, at 0.8 power factor, 125 degrees Celsius, 277, 480 volts, 60 Hz at 1800 rpm.

B. The alternator shall be a single bearing revolving field type, 2/3 pitch, 4-pole and shall be completely brushless. No commutator or commutator brushes shall be allowed. The main alternator and exciter shall be vacuum impregnated. The alternator shall be directly connected to the engine through a rigid coupling to insure permanent alignment. Voltage regulation shall be within plus or minus 1% of rated voltage, from no load to full load. Voltage recovery to rated voltage after acceptance of 100% of rated load in one step shall occur within 10 seconds. Provide a permanent magnet generator (PMG) excitation system. Motor starting capability shall be a minimum of 272 kVA. Rating for non-linear loads shall not be less than 30 kW at 0.8 power factor. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set. The instantaneous voltage dip shall be less than 10% of rated voltage when full load and rated power factor are applied to the alternator. Stable or study-state operation is defined as operation with terminal voltage remaining constant within plus or minus 1% of rated voltage. Temperature rise shall be within rating as defined by NEMA MG1-22.40. Radio interference reduction shall exceed requirements for general civilian or commercial applications with TIF less than 50 and wave form deviation less than 0.06 line to line.

C. Provide a 120 volt anti-condensation heater (minimum of 100 watts) to prevent condensation during non-operating periods. Heater shall be thermostatically controlled and rated for continuous use for the frame. Provide normal power to the heater.

D. Overload Rating: Capable of withstanding a three phase load of 300% rated current for 10 seconds, 150% of rated current for 60 seconds and 105% rated current for 60 minutes with field set for normal rated load excitation, and capable of withstanding an overspeed of 125%.

E. Performance Criteria:
1. Wave form Deviation: Less than 5%.
2. Crest Factor: 1.41 +/- 0.07.
3. Form Factor: 1.11 +/- 0.05.
4. Total Harmonic Distortion: 5%.
5. Single Harmonic Distortion: 3%.
6. Telephone Interference Factor: 50% maximum.
7. Dynamic Balance: Less than 1 mil displacement peak to peak.

F. Enclosure: NEMA MG1, open drip-proof.

G. Neutral Ground: As shown on drawings.

2.3 CONTROLS AND INSTRUMENTS

A. Provide comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 second. Acceptable methods are a 100% rated, 600 volt circuit breaker mounted in the generator enclosure. Provide Square D size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection.

B. A Generator Control Panel mounted on top of the alternator shall contain the following:
1. Run-stop-remote switch
2. Charge rate ammeter

3. Oil Pressure Digital Readout
4. Coolant Temperature Digital Readout
5. Remote start-stop terminals
6. Running time meter
7. Full A.C. Digital Display (A.C. ammeter, A.C. voltage, phase selector switch, frequency meter, and voltage adjustment.) All parameters shall have a readout of not less than 2.5% accuracy.
8. Red alarm lights shall be provided for each fault and alarm condition.
9. Two sets of spare terminals shall be provided for customer selected faults.
10. An Emergency Shutdown contact shall be provided through which customer's push button or other momentary-closing switch contacts shall shutdown the generator set engine.
11. A fault reset switch contacts shall shutdown the generator set engine.
12. A fault reset switch shall be provided to clear fault indications and allow restarting of the engine after shutdown faults.
13. The control design shall be such that the fault indication shall remain until reset. The fault indicator memory shall not be dependent on the presence of either AC or DC voltage and shall retain the fault status memory even through complete removal and replacement of the starting batteries.
14. A battery warning that includes load testing the battery on each crank shall be provided.
15. The fault reset function shall operate only when the RUN-STOP-REMOTE switch is in the STOP position.
16. All devices for interconnection and compatibility with digital accuracy and response shall be provided. Digital panels shall comply with electromagnetic interference requirements of Minimum Standard 461C - Part 9, and IEC Standard 801.2, 801.3 and 801.4. indication of voltage level
17. Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate; and be capable of being curve-matched to the engine torque curve with adjustments in the field.
18. The automatic voltage regulator shall be temperature compensated, solid-state design and include overvoltage and overexcitation protection functions. The voltage regulator shall be equipped with three phase RMS sensing. The regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. Overvoltage protection shall sense the AC generator output voltage and (in the event of regulator failure or loss of reference), shut down regulator output on a sustained overvoltage of one (1) second duration. Overexcitation protection shall sense regulator output and shutdown regulator output if overloads exceed ten (10) seconds in duration. Both overvoltage and overexcitation protection shutdowns shall be latched, requiring the AC generator to be stopped for reset.
19. The regulator shall include an under frequency rolloff torque-matching characteristics, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 Hz. The torque-matching characteristics shall include differential rate of frequency change compensation to use maximum available engine torque and provide optimal transient load response. Regulators which use a fixed volts per hertz characteristic are not acceptable.
20. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions.
21. All analog and digital metering shall be true-RMS indicating, and shall not be disrupted by non-linear load generated waveform distortion.
22. Digital metering set shall indicate generator RMS voltage and current, frequency, output current, output kW, kW-hours, and power factor. Generator output voltage shall be available in line-to-line neutral voltages and shall display all three phase voltages (line to neutral or line-to-line) simultaneously.
23. An under frequency sensing and protection system shall be provided which causes a shutdown of the generator set if true RMS frequency falls below 90% of rated frequency for more than 10 seconds.
24. The control system provided shall withstand the surge voltage produced by a 70A DC battery charging alternator operating at full load when the battery bank is disconnected. The test shall be successfully completed without tripping protective circuit breakers or blowing fuse protective devices.

25. All switches, lamps and meters shall be oil-tight and dust-tight and the enclosure door shall be gasketed.
26. All switches shall be provided with fully illuminated back-lit labels and all metering shall be individually lighted to allow for easy reading of functions in a completely dark room.
27. The field connections shall be made on permanently labeled terminal blocks, which are designed and tested by the manufacturer of the generator set to be suitable for use without wire termination lugs. Provisions shall be made for future addition of DIN-rail mounted components.
28. Control panel and interconnection enclosures shall be UL 508 listed as a unit assembly.
29. Communications:
    a. Alarm Relay Mode: Provide Form C alarm contacts that can be individually linked to alarm or status outputs from the generator set to external devices.
30. Interface to Site Monitoring System: Provide necessary electronic components and wiring to interface with and communicate the analog and digital status information to an owner provided site monitoring system. Include in this contract all work required for translation of proprietary protocol required to achieve this interface, and all licensing or other fees associated with this interface. Provide ethernet connection for integrating into modbus protocol.

2.4 ELECTRIC PLANT MOUNTING

A. The plant shall be provided with shock or anti-vibration mounts with the plant. Provide Korfund LKD spring-type isolators or type EU pads. Vibration isolation may be integrally a part of the generator set to the skid package. The plant's integral base shall have forklift sockets. Battery rack shall be integral part of plant base.

2.5 ACCESSORIES

A. All accessories needed for the proper operation of each plant shall be furnished. These shall include, but not limited to, the following:
1. Critical rated side inlet silencers with installation attachments for mounting within the set housing, flexible exhaust connection.
2. Belt driven battery charging alternator.
3. Lead acid starting batteries
4. Battery cables.
5. Fully automatic 120 volt, 10 amp battery charger. Cummins model number A048G602 or approved equal.
6. Natural Gas Fuel Train consisting of:
    a. Dry fuel strainer
    b. 12 VDC fuel solenoid valve
    c. Pounds-to-ounces primary gas pressure reducing regulator
    d. UL Listed braided metallic flexible fuel line
7. An oil drain valve with hose extension shall be provided for draining oil at the side of the plant.
8. Detailed operation and maintenance manuals with parts list.

2.6 REMOTE ALARM ANNUNCIATOR

A. Cummins No.0300-5929 shall be provided for flush mounting at inside location remote from the generator set located by the fire alarm control remote annunciator panel in the front administration office area.

2.7 AUTOMATIC TRANSFER SWITCH

A. Scope
1. Provide open transition automatic transfer switches (ATS) with the number of poles, amperage, voltage and withstand current ratings as shown on the plans. Each automatic transfer switch shall consist of an inherently double throw power transfer switch unit and a control module interconnected to provide complete automatic operation.

B. Codes and Standards
1. UL 1008 - Transfer Switch Equipment
2. NFPA 70 - National Electrical Code
3. NFPA 99 - Health Care Facilities Code

4. NFPA 110 - Standard for Emergency and Standby Power Systems

C. Mechanically Held Transfer Switch
1. The transfer switch unit shall be electrically operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
2. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction and be protected by separate arcing contacts.
3. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes.
4. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof are not acceptable.

D. Microprocessor Control Panel
1. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor.
2. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The operator panel shall allow starting and stopping of the generator set via the transfer switch operator panel in both test and emergency modes.

E. Enclosure
1. The ATS shall be furnished in a NEMA type 1 enclosure, for indoor use and NEMA4 for exterior use.

F. Voltage and Frequency Sensing
1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal, and dropout adjustable from 75% to 98% of pickup setting.
2. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 100% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.

G. Time Delays
1. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 6 seconds.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
3. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
4. A time delay shall be provided on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.

H. Additional Features
1. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal.
2. A momentary-type test switch shall be provided to simulate a normal source failure.
3. One set of auxiliary contacts rated 10 amps, 250 VAC shall be provided.
4. Position indicating lights shall be provided.
5. An in-phase monitor or delayed transition shall be provided for motor load applications.
6. Provide a field-programmable control which shall periodically start and run the generator with or without transferring the load for a preset time period, then re-transfer and shut down the generator after a preset cool-down period.

I. Withstand and Closing Ratings

1. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 3 cycle, long-time ratings. ATS's that are tested and labeled with specific breaker ratings only are acceptable. If current limiting fuses are utilized, provide current limiting fuses and disconnect switch mounted in or on Automatic Transfer Switch.

J. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

Note: Select if load bank is required including size and voltage

2.8 LOAD BANK

A. Electrical Connection: Power source to load bank connection is 3-phase, 3-wire plus ground. Additional control wire connections for remote control as required.

B. Load Bank Rating:
1. Capacity: 20 kW, 1.0 p.f.
2. Load Steps: 5 KW load step resolution
3. Voltage: 208 VAC, 3-ph., 3-W
4. Frequency: 60 Hertz
5. Air intake temperature: 155°F maximum (radiator air outflow)
6. Airflow requirements: Radiator air outflow
7. Duty Cycle: Continuous
8. Air temp. rise: 100°F, nominal
9. Air back pressure: 0.25 - 0.50" water column

C. Load Bank Design:
1. General: The load bank shall be a completely self-contained unit which includes all resistive load elements, load control devices, load element branch circuit fuse protection, main load bus and terminals, control terminals, system protection devices and enclosure of required type.
2. The load bank shall be the manufacturer's standard product that has been investigated, tested and listed by Underwriters Laboratories as a system for the purpose intended.
3. Enclosure: Type 3R, welded sheet steel, UL approved finish painted consisting of an epoxy primer and a polyurethane top coat, consisting of a power section, for installation and wiring of the load elements and a control section for installation and wiring of control components. The control section is to be physically and thermally isolated from both the hot load elements and the heated airflow. Mounting adapters suitable for the installation method selected shall be supplied with the load bank. The exhaust of the load bank shall be screened and, if installed outdoors, louvers shall be provided.
4. Load elements: Load elements shall be UL listed, labeled or recognized, Simplex Power Web Open wire, helically wound, chromium alloy, thermally derated to 60%. 5% tolerance, 2% balance. 0.995 p.f. element wire mechanically supported over entire length such that if a wire should break, the broken wire segments will not short to adjacent conductors or to ground. Load elements are individually serviceable and replaceable in the field without major disassembly of the load bank.
5. Load element short circuit protection: Branch circuit fuses, per each 50 kW load branch circuit. Fuses shall be 200,000 A.I.C. current limiting type.
6. Load control: One magnetic contactor per each fused branch circuit.
7. Load bank power wiring shall be 150°C insulated.
8. Main terminals: Plated bus bar with a hole pattern to accept customer supplied cable
9. Control wiring shall be 105°C insulated.
10. Control power shall be derived internally from the main load bus. Control and protective circuits shall operate at 120V via control power transformer or line-neutral circuit and shall be fused.
11. System protection: The load bank shall include a comprehensive protection system to protect against overheating. The system shall function to disconnect the load elements from the power source and activate an alarm upon sensing a loss of cooling airflow, or an exhaust air temperature greater than 300 degrees Fahrenheit.
12. The load bank shall be installed adjacent to the generator on a concrete pad.
13. Load bank shall automatically connect to the generator when the running load is less than 30% and automatically disconnect when the load exceeds 50%.

2.9 OUTDOOR WEATHER-PROTECTIVE HOUSING

A. Generator set housing shall be provided factory-assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two-step electro-coating paint process, or equal, meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
1. Primer thickness, 0.5 - 2.0 mils. Top coat thickness, 0.8 - 1.2 mils.
2. Gloss, per ASTM D523, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
3. Crosshatch adhesion, per ASTM D3359, 4B-5B.
4. Impact resistance, per ASTM D2794, 120-160 inch-pounds.
5. Salt spray, per ASTM B117, 1000+ hours.
6. Humidity, per ASTM D2247, 1000+ hours.
7. Water soak, per ASTM D2247, 1000+ hours.

B. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.

C. A 120 VAC heater with thermostat shall be provided within the generator set control panel to eliminate condensation. Contractor shall provide 120 volt, 20 amp circuit.

2.10 OUTDOOR SOUND ATTENUATED WEATHER-PROTECTIVE HOUSING

A. The generator set shall be provided with a factory-installed housing to allow the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to an maximum of 65.4 dBA, which shall be an eight-position average of any location 7 meters from the geometric center point of the generator set in a free field environment. Housing configuration and materials used may be of a suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass. The acoustical housing shall match the standard footprint of the standard housing-ready generator set base. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad lockable door latches shall be provided for all doors. Door hinges shall be stainless steel. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two-step electro coating paint process, or equal, meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating which meets the following requirements:
1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
2. Gloss, per ASTM D523, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
3. Crosshatch adhesion, per ASTM D3359, 4B-5B.
4. Impact resistance, per ASTM D2794, 120-160 inch-pounds.
5. Salt spray, per ASTM B117, 1000+ hours.
6. Humidity, per ASTM D2247, 1000+ hours.
7. Water soak, ASTM D2247, 1000+ hours.

B. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion-resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.

C. A 120 VAC heater with thermostat shall be provided within the generator set control panel to eliminate condensation. Contractor shall provide 120 volt, 20 amp circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install generator and housing on a minimum 6 inch high reinforced concrete housekeeping pad. Provide blockouts as required. Bolt the generator to the pad. The pad shall be designed by a structural engineer. Provide working clearances and operational air flow clearances as required by the manufacturer.

B. Install the load bank on a minimum 6 inch high reinforced concrete housekeeping pad. Provide blockouts as required. Bolt the load bank to the pad. The pad shall be designed by a structural engineer. Provide working clearances as required by the manufacturer.

C. Provide all power wiring, control wiring, additional contacts and relays required for a complete installation. All conduit shall be in a two-hour enclosure. Underground conduits shall be concrete encased. The wall mounted dual rate battery shall be taken offline during the starting of the generator. The generator belt driven alternator shall charge the batteries when the generator is running.

D. Provide conduit and wire routed from the auxiliary contacts in the automatic transfer switch to the elevator controller. The purpose of this wiring is to signal the elevator controller when it is connected to emergency power.

E. Install generator set and transfer switches in accordance with manufacturer's instructions.

F. The generator shall be installed as a separately derived system. Contractor shall connect the generator neutral to a grounding electrode. Provide a bonding jumper from the ground bar to neutral.

G. Provide engraved plastic nameplates under the provisions of Section 26 02 00.

H. For interior generator installation applications, provide insulation for engine exhaust pipe from exhaust manifold to outside terminal as described in Section 23 07 19.

3.2 WARRANTY

A. The complete standby electric power system, including engine-generator set equipped with set exerciser, and running time meter, shall be warranted for a period of five years from the date of initial start-up. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. This warranty shall be as detailed in available written documents. In the judgement of the specifying authority, the manufacturer supplying the warranty for the complete system must have necessary financial strength and technical expertise with all components supplied to provide adequate warranty support. All items of the engine, generator, and controls that are warranted in the first year shall be covered for the full five year term of the warranty. Warranty coverage shall include parts, labor, and travel for the full term of the warranty.

B. Extensions of warranty term up to 10 years from start-up and inclusion of comprehensive terms shall be available for one year after start-up.

3.3 TESTS

A. Factory production model tests: Before shipment of the equipment, the generator set shall be tested under rated load and power factor for performance and proper functioning of control and interfacing circuits. Testing at unity power factory only (resistance banks only) is not acceptable, since kW output is affected by the higher generator efficiency at unity power factor, and the kVAR for motor starting and regulation loads is not correlatable between unity and rated power factor. Other tests shall include:
   1. Single step load pickup per NFPA 110.
   2. Transient response and steady state governing.
   3. Safety Shutdowns.
   4. Prototype tests in accordance with NFPA 110 level 1 have been done on a complete and functional set. Component level type tests will not substitute for this requirement.

B. The engineer shall be notified in advance of these test and shall have the option of witnessing these tests. Certified copies of test results shall be forwarded to the engineer for review.

C. Field Test After Installation:
1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representative(s) of the engine-generator set and transfer switch manufacturer. The engine lubrication oil and antifreeze, as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the engine-generator set supplier.
2. Upon completion of initial start-up and system checkout, the supplier of the generator set shall perform a field test, with the engineer notified in advance, to demonstrate load carrying capability, stability, voltage, and frequency. The engineer shall be present during the field test.
3. The generator shall be run for four hours continuously with all available facilities emergency load connected to its output; in addition, the generator set supplier must provide a portable load bank to supplement any existing load to enable full load testing. Load shall not exceed 50% of generator-set rating for first 1/2 hour during first initial run for proper engine break-in. Records shall be maintained throughout this period to record water temperature, oil pressure, ambient air temperature, voltage, current, frequency, kilowatts, and power factor. The above data shall be recorded at 15 minute intervals throughout the test. There shall be a 10 minute unloaded run at the conclusion of the test to allow engine to cool before shutdown. Three copies of the field test data shall be furnished to the engineer. The contractor shall make all necessary hook-ups to accomplish field tests and shall furnish all fuel necessary for field test and start-up.

3.4 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/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.

END OF SECTION

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SECTION 26 36 13

MANUAL TRANSFER SWITCH AND DOCKING STATION (ROBINSON)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Provide a four-pole manual transfer switch and docking station. Refer to drawings for voltage and ampacity. Provide 65,000 A.I.C.

1.3 REQUIREMENTS

A. Level 1 applications are legally-required emergency systems. Level 2 applications are standby systems.

B. The electric generating system must meet all requirements of NFPA 110 including design specification, prototype tests, one-step full-load pickup, and installation acceptance. Engine-generator system to provide source of power for Level 1.

C. Comply with requirements of NFPA 99 as applicable.

D. Comply with requirements of IEEE 446 as applicable.

1.4 REFERENCE STANDARDS

A. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications; 1995.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

E. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. Shop drawings shall include but not be limited to:
1. Catalog cut sheets with all equipment, accessories and devices including all ratings.
2. Complete bill of materials.

B. Operation and Maintenance Data
1. Submit under provisions of Division One.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One and in accordance with manufacturer's instructions.

B. Accept unit on site on skids. Inspect for damage.

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.7 WARRANTY

A. The transfer switch shall be warranted for a period of five years form the date of initial start-up.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products complying with these specifications and produced by one of the following:
1. ASCO
2. Trystar
3. Eaton
4. Russelectric

B. The transfer switch manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center’s personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

2.2 KIRK KEY INTERLOCKED MANUAL CIRCUIT BREAKER TRANSFER SWITCH

A. The transfer switch unit shall be manually operated and held by a kirk key interlock. Two breakers shall be kirk key interlocked to ensure only one of two possible positions, Source 1 or Source 2. Fused disconnect type switches shall not be acceptable. Provide line side lugs. Basis of design, Trystar DBDS-1 Series.

B. Both breakers shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life. Manual transfer switch shall consist of two breakers rated at 65,000 AIC and cam style male connectors. Siemens, ABB, Schneider and Eaton are appoved breaker manufactures.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

E. All transfer switches and mechanical operating mechanisms shall be the product of the same manufacturer.

2.3 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off. Fused disconnect type switches shall not be acceptable. Provide line side lugs.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

E. All transfer switches and mechanical operating mechanisms shall be the product of the same manufacturer.

2.4 DOCKING STATION

A. The docking station shall include phase color camlocks with flip covers and mechanical lugs for hard wiring conductors. Each camlock shall be rated at 400 amps and 600 volts. Camlocks colors shall match appropriate voltage indicated in specification Section 26 05 19.

B. Provide the following camlocks and lugs:
1. 400 amps or less – 1 set of cam locks per phase and neutral. Lugs: 3/0 thru 600 kCMIL
2. 600A – 2 sets of cam locks per phase and neutral. Lugs: 2 sets of 3/0 thru 600 kCMIL
3. 800A – 2 sets of cam locks per phase and neutral. Lugs: 2 sets of 3/0 thru 600 kCMIL
4. 1200A – 3 set per phase and neutral sets of cam locks per phase and neutral. Lugs: 3 sets of 3/0 thru 600 kCMIL
5. 1600A – 4 set per phase and neutral sets of cam locks per phase and neutral. Lugs: 4 sets of 3/0 thru 600 kCMIL
6. 2000A – 5 set per phase and neutral sets of cam locks per phase and neutral. Lugs: 5 sets of 3/0 thru 600 kCMIL
7. 2500A – 7 set per phase and neutral sets of cam locks per phase and neutral. Lugs: 7 sets of 3/0 thru 600 kCMIL
8. 3000A – 8 set per phase and neutral sets of cam locks per phase and neutral. Lugs: 8 sets of 3/0 thru 600 kCMIL
9. 4000A – 10 set per phase and neutral sets of cam locks per phase and neutral. Lugs: 10 sets of 3/0 thru 600 kCMIL

2.5 ENCLOSURE

A. Provide NEMA 1 enclosures for interior and NEMA 3R or NEMA 4X for exterior locations per NEMA 250.

B. Provide Manual Transfer Switch with integral docking station when indicated. Provide double doors to allow access to camlocks and lugs.

C. Provide 120 volt, 125 watt thermostat controlled heat strip with disconnect for outdoor or non-conditioned locations.

2.6 ACCESSORIES

A. Provide Aux contacts to be connected to the permanent generator annunciator.

B. Provide labeling indicating required phase rotation and bonding requirements.

2.7 WITHSTAND AND CLOSING RATINGS

A. The transfer switch shall be UL listed in accordance with UL 1008 and be labeled in accordance with the standard’s 3 cycle, long-time ratings. Transfer switches that are not tested and labeled with 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable unless the switch performance is guaranteed and UL listed for molded case circuit breakers or current limiting fuses. If current limiting fuses are utilized, provide current limiting fuses and disconnect switch mounted in or on the transfer switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all power wiring, control wiring, additional contacts and relays required for a complete installation. All conduit shall be in a two hour enclosure. Underground conduits shall be concrete encased.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NFPA 70.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Provide engraved plastic nameplates under the provisions of Section 26 02 00.

F. Manual Transfer Switches and Docking Stations less than 800 amps shall be wall mounted to a steel rack.

G. Manual Transfer Switches and Docking Stations 800 amps and larger shall be mounted on a 6-inch reinforced concrete pad. Bolt this equipment to the pad. Provide blockouts as required.

H. Combination manual transfer switch and docking stations larger than 800 amp shall be mounted on a 6-inch reinforced concrete pad.

3.2 TESTS

A. Field Test After Installation:
1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representatives of the engine-generator set and transfer switch manufacturer.

3.3 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/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

B. Training
1. Provide training designed for a minimum of four persons, to include:
2. Training in the system operation in all possible configurations.
3. Training in the maintenance of the system.
4. Minimum of four hours of instruction, but sufficient to cover all items specified.
5. Four sets of instruction materials.

END OF SECTION

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES WITH BYPASS ISOLATION (ROBINSON)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Provide automatic transfer & bypass-isolation switch (ATS/BPS) system(s) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each automatic transfer shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All automatic transfer & bypass-isolation switches and controllers shall be the products of the same manufacturer.

1.3 REQUIREMENTS

A. Level 1 applications are legally-required emergency systems. Level 2 applications are standby systems.

B. The electric generating system must meet all requirements of NFPA 110 including design specification, prototype tests, one-step full-load pickup, and installation acceptance. Engine-generator system to provide source of power for Level 1.

C. Comply with requirements of NFPA 99 as applicable.

D. Comply with requirements of IEEE 446 as applicable.

1.4 REFERENCE STANDARDS

A. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications; 1995.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 99 - Health Care Facilities Code; 2024, with Errata.

E. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.

F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. Shop drawings shall include but not be limited to:
1. Catalog cut sheets with all equipment, accessories and devices including all ratings.
2. Complete bill of materials.

B. Operation and Maintenance Data
1. Submit under provisions of Division One.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One and in accordance with manufacturer's instructions.

B. Accept unit on site on skids. Inspect for damage.

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.7 WARRANTY

A. The transfer switch shall be warranted for a period of five years form the date of initial start-up.

1.8 ACCEPTABLE MANUFACTURERS

A. Provide products complying with these specifications and produced by one of the following:
1. ASCO
2. Cummins Power Generation/Onan

B. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center’s personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

PART 2 - PRODUCTS

2.1 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch unit shall be electrically operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of the two possible positions, normal or emergency, may be held.

B. All main contacts shall be silver in composition.

C. Inspection of all contacts shall be possible from the front of the switch without disassembly of the operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes.

D. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof are not acceptable.

E. Where neutral conductors must be switched as shown on the plans, the AS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

2.2 BYPASS-ISOLATION SWITCH

A. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

B. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.

C. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

D. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

E. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

F. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

G. Designs requiring operation of key interlocks for bypass isolation or ATSs which cannot be completely withdrawn when isolated are not acceptable.

2.3 MICROPROCESSOR CONTROL PANEL

A. The controller’s sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

B. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of -20 to +60 degrees C and storage from -55 to +85 degrees C.

C. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator’s manuals.

D. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

2.4 ENCLOSURE

A. Transfer switches / BPS shall be furnished in a NEMA 1 enclosure per NEMA 250.

2.5 VOLTAGE AND FREQUENCY SENSING

A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal and dropout adjustable from 75% to 98% of pickup setting.

B. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 100% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.

2.6 ADDITIONAL FEATURES

A. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage start signal.

B. One set of auxiliary contacts, rated 10 amps, 250 VAC shall be provided.

C. Position indicating lights shall be provided.

2.7 WITHSTAND AND CLOSING RATINGS

A. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with the standard's 3 cycle, long-time ratings. Transfer switches that are not tested and labeled with 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable unless the switch performance is guaranteed and UL listed for molded case circuit breakers or current limiting fuses. If current limiting fuses are utilized, provide current limiting fuses and disconnect switch mounted in or on the transfer switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all power wiring, control wiring, additional contacts and relays required for a complete installation. All conduit shall be in a two hour enclosure. Underground conduits shall be concrete encased.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NFPA 70.

D. Provide engraved plastic nameplates under the provisions of Section 26 02 00.

3.2 TESTS

A. Field Test After Installation:
1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representatives of the engine-generator set and transfer switch manufacturer.

3.3 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/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

B. Training
1. Provide training designed for a minimum of four persons, to include:
2. Training in the system operation in all possible configurations.
3. Training in the maintenance of the system.
4. Minimum of four hours of instruction, but sufficient to cover all items specified.
5. Four sets of instruction materials.

END OF SECTION

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SECTION 26 43 13.13

SURGE PROTECTIVE DEVICES (SPD) - STANDARD INTERRUPTING (ROBINSON)

LPART 1 - GENERAL

1.1 SCOPE

A. Specify the electrical and mechanical requirements for a non-modular high-energy surge protective device system (SPD). The specified system shall provide effective high energy surge current diversion and be suitable for application in IEEE C62.41.1 Category A, B and C3 environments, as tested by IEEE C62.11, IEEE C62.45.

B. The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1-volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable. Devices shall utilize a minimum of three (3) MOV's fuse links pair per phase. This will allow greater than 50% redundant protection in if a MOV fails.

C. Third Party Test Report verifying surge current rating, longevity, testing, and filtering capabilities shall be provided with submittal.

1.2 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:
1. Canadian Standards Association (CSA or CUL)
2. American National Standards Institute and
3. Institute of Electrical and Electronic Engineers (IEEE C62.11, IEEE C62.41.1, IEEE C62.41.2 and IEEE C62.45)
4. Institute of Electrical and Electronic Engineers 1100 Emerald Book
5. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
6. National Electrical Manufacturer Association (NEMA LS-1 1992)
7. National Fire Protection Association (NFPA 20, NFPA 70, NFPA 75 and NFPA 780)
8. National Electric Code
9. Underwriters Laboratories (UL 1449 and UL 1283)
10. International Electrotechnical Commission (IEC 801)
11. International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
12. EMC Directive 89/336/EEC - CE compliant

B. The systems individual units shall be UL/ANSI Listed and labeled under UL 1449 (Fourth Edition) Standard for Surge Protection Devices Type 2 20kA with a nominal discharge current of 20kA and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL 1283 for type 2 locations Standard for Electromagnetic Interference Filters, and CSA/CUL Listed.

1.3 ACCEPTABLE MANUFACTURERS

A. Southern Tier Technologies

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:
1. Cutsheets of surge protection devices with ratings, physical dimensions and all accessories clearly labeled.
2. Device labels shall be clearly indicated in cutsheets.

3. All standards and listings, as specified in section 1.2A-B, shall be clearly labeled in cutsheets provided.
4. Cutsheets shall clearly outline that design requirements of this specification have been met.

1.5 QUALITY ASSURANCE

A. The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of surge protection equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 - PRODUCTS

2.1 ENCLOSURE

A. The specified system shall be provided in a heavy duty NEMA 4 or better dust-tight, drip-tight enclosure with no ventilation openings.

2.2 OVERCURRENT PROTECTION (FUSING)

A. Individual surge components shall be fused to prevent violent failure. The fusing shall be UL listed and shall be capable of interrupting up to 200kA symmetrical fault current with 480VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable. Devices that utilize a single fuse to protect two or more suppression paths are not accepted.

2.3 DESIGN REQUIREMENTS

A. Protection Modes:
1. The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B. UL 1449 Ratings:
1. The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following in any mode of protection:

System Voltage	Voltage Protection Rating			
	L-N	L-L	N-G	L-L
120/240	600-volts	700-volts	700-volts	1200-volts
120/208	600-volts	700-volts	700-volts	1200-volts
240		1200-volts		1000-volts
277/480	1200-volts	1200-volts	1200-volts	1800-volts
480		1800-volts		1800-volts

C. Noise Attenuation:
1. The unit shall be UL 1283 Listed as an electromagnetic interference filter in type 2 locations. The filter shall provide insertion loss with a maximum of 60 dB from 100 KHz to 100 MHz per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120 dB insertion loss from 100 KHz to 100 MHz when used in a coordinated facility system.

D. Life Cycle Testing:
1. The SPD system shall be duty life cycle tested to survive 6,000 20kV, 10kA Surges, per IEEE C62.41.1 Category C3 surge current with less than 5% degradation of clamping voltage.

2.4 CONNECTIONS

A. Provide 60” wire leads #10 AWG or UL 1449 tested size.

2.5 STANDARD FEATURES

A. Unit Status Indicators:
1. Red and green solid state indicators with printed labels shall be provided on the front cover to redundantly indicate on-line unit status including N-G monitoring. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

B. Dry Contacts for remote monitoring:
1. Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

C. Undervoltage detection:
1. Unit shall be equipped with 70% undervoltage detection capability.

D. Phase Loss Monitoring:
1. Unit shall be equipped with phase loss monitoring.

E. Power Loss Monitoring:
1. Unit shall be equipped with power loss monitoring.

2.6 TESTING

A. Component Testing and Monitoring:
1. Unit shall include an on-line circuit which tests and redundantly monitors individual components in all protection modes including neutral to ground (where applicable). Units that require external test sets or equipment are not acceptable.

2.7 ENVIRONMENTAL REQUIREMENTS

A. Storage Temperature: -55 to +85 C (-67 to +187 F)

B. Operating Temperature: -40 to +60 C (-40 to 140 F)

C. Relative Humidity: 0% to 95%

D. Audible Noise: less than 45 dBa at 5 feet (1.5 m).

E. Operating Altitude: 0 to 18,000 feet above sea level.

2.8 WARRANTY

A. The manufacturer shall provide a full 10 year parts and a 5 year labor warranty from date of shipment against any part failure when installed in compliance with manufacturer’s written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48 hour assessment. A 24 hour 800 number must be available to support warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes. Provide STT Tierguide cable if the cable length exceeds 5 feet from the circuit breaker servicing the SPD.

B. Provide Flush Mount Stainless Steel Cover Kit for kitchen areas.

C. Provide Flush Mount Cover Kit for residential units and hotel suites.

END OF SECTION

SECTION 26 51 19

LIGHTING FIXTURES - LIGHT EMITTING DIODE (LED) (GOFORTH ROBINSON)

PART 1 - GENERAL

1.1 SCOPE

A. Provide general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B. The types of lighting fixtures required for this project include:
1. LED

1.2 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

C. NEMA JSC 10410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

G. UL 1012 - Safety Power Units Other Than Class 2; 2010.

H. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

I. NFPA 101

J. NEMA-LE

K. TM-21

L. LM-80

M. LM-79

N. L70

O. DLC

1.3 QUALITY ASSURANCE

A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings. “ETL listed” is an acceptable listing.

B. All LED drivers shall be UL recognized Class 2 per UL 1310 or non-Class 2 per UL 1012 as applicable.

C. All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR 15, for Non-Consumer Equipment.

D. All LED drivers shall be RoHS compliant.

1.4 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as shown and scheduled.

B. LED DRIVER:
1. Provide one of the following manufacturers
   a. Eldo
   b. Lutron
   c. Osram
   d. Philips

C. LAMPS:
1. Provide one of the following LED Chip manufacturers
   a. Cree
   b. Nichia
   c. North American Philips
   d. Seoul
   e. Lumileds

1.5 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B. Provide driver and LED module data brochures for each fixture type.

C. Provide air handling and heat removal data for light fixtures specified with these requirements.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:
1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General:
1. Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, LED modules, lamp holders, drivers, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B. Lighting Fixture Types:
1. LED Fixtures
   a. Fixtures shall be pre-wired with frame-in kit and integral thermal management system for fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.

b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.
c. Interior LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50µs, 2 ohm combination wave).
d. Exterior LED fixtures shall have integral common mode and differential mode surge protection of 10kV/10kA(1.2/50µs, 2 ohm combination wave).

2. Exit signs
   a. Exit signs shall meet all federal, state and local codes.
   b. Provide fire alarm interface relay when required to flash exit signs.
   c. Provide battery packs for emergency operation when not connected to emergency generator power.

2.2 LED MODULES AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED
1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.
2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.
3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).
4. Provide driver with integral color-coded leads.
5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.
6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.
7. Provide drivers with a Class A sound rating.
8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).
9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.
11. Driver performance requirements shall be met when operated to 50% of full load rating.
12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
13. Drivers shall comply with NEMA JSC 10410 for in-rush current limits.
14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

2.3 LAMPS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED Lamps shall be appropriately matched to the driver with junction-down design for improved thermal management. Maximum DC Forward Current.

2.4 EMERGENCY LED BATTERY BACKUP

A. Provide Bodine #BSL310M for emergency light fixtures in 9 or 10-foot ceiling.

B. Provide Bodine #BSL20 for emergency LED driver for emergency light fixtures in ceiling heights greater than 12 feet.

C. Provide Bodine #BSL17-C2 for emergency LED driver for LED downlights.

D. Provide unswitched hot leg. Hot leg shall originate from the same branch circuit as required in article 700.12 (F) of NFPA 70.

2.5 POLES

A. Provide poles for area lighting fixtures as specified. Poles shall be one piece, anchor base, with 2-piece steel bolt cover and vibration dampers. Poles shall be round straight steel as specified on the Lighting Fixture Schedule.

B. Provide all poles with appropriate mounting accessories including arms, tenons, or bullhorns as required. Anchor bolts shall be hot dipped galvanized, sized as required by the manufacturer of the pole.

C. All poles shall have a normal 3” x 5” hand hole at 18” above the base flange and grounding provision.

D. Poles shall be prime painted interior and exterior. The exterior shall be finished with polyester powder coating and architectural finish as specified by the Architect. The interior with 3 mil thermoplastic hydrocarbon resin, or equivalent to meet 1000-hour salt spray exposure (ASTM B117).

2.6 BRANCH CIRCUIT EMERGENCY TRANSFER SWITCH (BCELTS)

A. Provide 20 amp, 120-277 Volt, UL 1008 listed Branch Circuit Emergency Transfer Switch to control emergency light fixtures transferring from normal to emergency branch circuits Provide Bodine GTD 20A or ETC SC 1008 UL 924 Devices are not acceptable

2.7 AUTOMATIC LOAD CONTROL RELAY (ALCR)

A. Provide 3 amp, 120-277 volt UL 924 listed. Relay to bypass switching controlling emergency branch circuit light fixtures Provide Bodine GTD or Wattstopper ELCU.

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. General
1. Install the type of lighting fixture where shown and indicated in accordance with manufacturer's written instructions.
2. Provide earthquake clips on all recessed lay-in lighting fixtures as required by building code.
3. Adjust all adjustable lighting fixtures, as directed by the Architect.
4. Provide safety chains and wire guards for lighting fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination
1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.
2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.
3. Refer to architectural reflected ceiling plan for the exact location of all lighting fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting
1. Provide support channels to support outlet boxes used support surface mounted lighting fixtures such as exit signs or downlights.

2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.
3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.
4. Provide secondary support wires from all four (4) corners of the lay-in fixtures to the structure above. Do not support fixtures from ceiling grid wire supports, piping, conduit, side walls, or mechanical equipment. Ceiling specifications do not supersede this requirement.
5. Where pole mounted luminaries are provided, provide appropriate anchor base pole as specified with manufacturer’s recommended anchor bolts. Verify exact location on site for poles with Architect, Civil, and Landscape documents. Poles shall be installed on proper footing. Refer to details on the drawings. Provide grounding connection to a separately driven ground rod, outside of the footing. Where indicated provide pole with identification plate indicating pole number.
6. Ground mounted flood type fixtures and flagpole lights, or similar fixtures, shall include stanchion and knuckle mount. Stanchion shall be supported by concrete base.
7. Flagpole mounted fixtures called out to be mounted on the flagpole shall be provided with tenon mount adapter and yoke.

D. Electrical Connection
1. All light fixtures shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 8'- 0". Provide #12 AWG conductors. All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

E. Fire Rated Ceiling
1. Provide fire rated canopy or enclosure for all fixtures recessed in a fire rated ceiling. The fire rated canopy or enclosure shall be as required by the UL design number listed in the UL fire resistance directory. Refer to architectural drawing for the UL design number. Coordinate with ceiling installer and manufacturer. Provide proper rated drivers for lighting fixtures installed within these rated enclosures.

F. Air Handling Fixtures
1. Install all air handling light fixtures with return air slot in the open position, if it is to be as an air handling fixture. Coordinate with mechanical contractor.

3.2 FINAL INSPECTION

A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B. Replace all other defective fixtures showing signs of excessive usage.

C. Demonstrate proper operation of all fixtures and controls. Refer to other sections and details on the drawings for lighting controls.

END OF SECTION

SECTION 31 00 00

SITE EARTHWORK

PART 1 GENERAL

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 AASHTO Standard T 99 procedure.

PART 2 PRODUCTS

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 EXECUTION

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 AASHTO Test Method T99.

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 AASHTO Test Method T99.

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

SECTION 31 06 20.15

CEMENT STABILIZED SAND

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cement stabilized sand.

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 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.

1.5 Submit proposed target cement content and production data for sand-cement mixture in

accordance with requirements of Paragraph 2.03, Materials Qualifications. 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 PRODUCTS

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 EXECUTION

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 stabililized 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 purpose.

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 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 than 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

SECTION 31 06 20.17

UTILITY BACKFILL MATERIALS

PART 1 GENERAL

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. Stipulated Price (Lump Sum). Contract is a 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 PRODUCTS

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 EXECUTION

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

SECTION 31 11 00

SITE CLEARING AND GRUBBING

PART 1 GENERAL

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. Stipulated Price (Lump Sum). Contract is a 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 PRODUCTS - Not Used PART

3 EXECUTION

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 topsoil 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

SITE GRADING

PART 1 GENERAL

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 thatremain.

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 PRODUCTS

2.1 MATERIALS

A. Topsoil - Soil Type : Topsoil excavatedon-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 EXECUTION

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

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete paving.

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 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. ASTMC494 -Standard Specification for Chemical Admixtures for Concrete.

T. ASTMC618 -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 PRODUCTS

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:

	Percent by Weight of Total Sample

Item	Maximum
Clay lumps and friable particles Material finer than 75-um (No. 200) sieve: Concrete subject to abrasion All other concrete	3.0 3.0* 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-pm (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 1%" sieve	0
Retained on 1%" sieve	0 to 5
Retained on %" 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:

E.

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.

F. 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.

G. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

H. 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.

I. 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

2.3 Conform Equipment to requirements of ASTM C 94.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 EXECUTION

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. Concrete Finishing

Surface	Finish	Thickness	Strength
Sidewalks	Broom, Medium	4 1/2”	3,000 psi
Parking	Broom, Heavy	5”	3,500 psi
Drives	Broom, Heavy	6”	3,500 psi

D. 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.

E. 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.

1. 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 inplace 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 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.

3.16 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 PAVING CURING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

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 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 PRODUCTS

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 EXECUTION

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

SECTION 32 13 13.25

CONCRETE SIDEWALKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

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 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 PRODUCTS

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 EXECUTION

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 GENERAL

1.1 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.2 MEASUREMENT AND PAYMENT

A. 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 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 PRODUCTS

2.1 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.2 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.3 JOINT SEALING COMPOUND

A. 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 EXECUTION

3.1 PLACEMENT

A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling, or cracks.

3.2 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.3 EXPANSION JOINTS

A. Place 3/4 inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart 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 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section pertains to the establishment of vegetative cover by Hydromulching or Sodding as indicated on the drawings and as specified herein.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 REGULATORY REQUIREMENTS

A. Contractor shall comply with all current, applicable codes and regulations.

B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.

C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.4 SUBMITTALS

A. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.

B. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 QUALITY ASSURANCE

A. Install lawns only when weather and soil conditions are deemed by the Owner’s Representative to be suitable for proper placement. Do not install lawns during rainy or freezing weather, or when soil is frozen.

1.6 MAINTENANCE SERVICE

A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
   1. Seeded Lawns: 90 days from date of planting completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
   2. Sodded Lawns: 30 days from date of planting completion.

B. Reseed or Resod unacceptable areas.

1.7 WARRANTY

A. Time Period: Warrant that lawns are in healthy and flourishing condition of vigorous active growth one year from date of Final Acceptance.

B. Appearance During Warranty: Lawns shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.

C. Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or Acts of God during Warranty Period. Report such conditions in writing.

PART 2 - PRODUCTS

2.1 LAWN SEED

A. 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 (Lb/Ac)	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

B. 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

C. 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.

D. Soil Stabilizer: "Terra Tack 1" or approved equal.

E. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

2.2 LAWN SOD

A. Species: St. Augustine (Stenotaphrum Secundatum) Gulf Coast variety to match existing sod or as indicated on the Drawings.

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.
1. Sod shall be rejected if found to contain any amount of the following weeds:
   a. Quackgrass.
   b. Johnson grass.
   c. Poison ivy.
   d. Nimbleweed.
   e. Thistle.
   f. Bindweed.
   g. Bentgrass.
   h. Perennial sorrel.
   i. Bromegrass.

C. Size: 12 inch wide strips, uniformly 2 inches thick with clean-cut edges. Rhizome development should be apparent.

D. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.

2.3 TOP DRESS FERTILIZER

A. (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to the derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:
1. 16% Nitrogen
2. 6% Phosphoric Acid
3. 8% Potash

2.4 WEED AND INSECT TREATMENT

A. Provide acceptable treatment to protect sod from weed and insect infestation. Submit treatment method to Project Manager for approval. Install insect and disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.

2.5 WATER

A. Potable, available on-site through Contractor's water trucks.

2.6 BANK SAND

A. Free of clay lumps, roots, grass, salt or other foreign material.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that grades are within 1-inch plus or minus the required finished grades. Verify that all soil preparation has been completed and approved. Report all variations in writing.

B. Stones, Weeds, Debris: Verify that all areas to receive lawns and grasses are clear of stones larger than 1-1/2 inch in diameter, weeds, debris, and other extraneous materials.

C. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.2 SODDING

A. Sod Bed Preparation:
1. Rolling: Roll amended soil with 200 pound water-ballast roller.
2. Moistening Soil Surface: After all unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.
3. Timing: Sod immediately thereafter, provided the sod bed has remained in friable condition.

B. Sodding Operations :
1. Big roll sod shall be installed by tractors with proper flotation tires of by an approved big roll sod installation machine. Care should be taken to roll out sod at a proper speed so that no humping or tearing of sod occurs. Sod will be manually pulled together by stiff rakes to insure no gaps remain in the seams. Joints should be staggered. Damaged or problem areas shall be cut out and replaced in a professional matter.
2. Starter Strip:
   a. Lay first row of sod in a straight line, with subsequent rows parallel to and tightly against each other.
   b. Stagger lateral joints.
   c. Do not stretch or overlap sod.
   d. Butt all joints tightly to eliminate all voids.
3. Cutting: Use a sharp knife to cut sod to fit curves, surface components of the irrigation system or other items.
4. Tamping and Rolling: Thoroughly tamp and roll sod to make contact with sod bed. Roll each entire section of completed sod.

5. Watering: Thoroughly water sod immediately after installation to wet the underside of the new sod pad and the soil immediately below to a depth of 6 inches. Maintain constant moisture for 2 weeks or until sod is fully rooted.
6. Top-Dress Fertilizer: Apply at the rate of (6) to (8) pounds per 1,000 square feet at 25 days and at 50 days after sodding.

3.3 HYDROMULCH SEEDING

A. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient of agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Engineer may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

B. Mixing: Care shall be taken that the slurry preparation should be accomplished per the material supplier's recommendations and the equipment manufacturer's written operations manual. Spraying shall commence immediately when the slurry is mixed and the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

C. Application:
1. Contractor shall obtain approval of hydromulch area preparation from the Engineer prior to application.
2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
3. Keep hydromulch within areas designated and keep from contact with other plant material.
4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.
5. After application, the Contractor shall not operate any equipment over the covered area.
6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.
7. All areas designed on drawings shall be covered uniformly with specified materials using hydromulching processes. If surfaces remain uncovered within the designated area, the Contractor shall make additional applications of specified hydromulch planting to bare areas not meeting specified coverage as determined by the Owner's Representative. Such replanting to be performed immediately upon notification by the Owner's Representative.

3.4 MAINTENANCE

A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.

B. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
   1. Seeded Lawns: 90 days from date of planting completion.
      a. For areas seeded in fall or if lawn is not fully established, continue maintenance following spring until acceptable lawn is established.
   2. Sodded Lawns: 30 days from date of planting completion.

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 hydromulch.

E. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing.

3.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:
   1. For Seed: Ninety Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.
   2. For Sod: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. The Owner's Representative shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

END OF SECTION 32 92 00

SECTION 32 91 13.13

TOPSOIL PLACEMENT AND GRADING

PART 1 GENERAL

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. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

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 EXECUTION

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 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

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. 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. 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 (Nonshrink)

I. ASTM D 698 -Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/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 PRODUCTS

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 EXECUTION

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 nonshrink 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 0513

SECTION 33 05 16.13

PRECAST CONCRETE UTILITY STRUCTURES

PART 1 GENERAL

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. 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 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 PRODUCTS

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 EXECUTION

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

SECTION 33 05 16.16

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 GENERAL

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. 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. 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- StandardSpecification for Chemical Admixtures for Concrete.

FF. ASTM C 595- StandardSpecificationfor Blended Hydraulic Cements.

GG. ASTM C 685- StandardSpecification for Concrete Made by Volumetric Batchingand 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 PRODUCTS

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.

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.

1. Fiber: Fibrillated Polypropylene Fiber:
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 Minimum Average Tensile Strength: 50,000 psi 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

6) 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.

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			
A	Structural	3200	4000	0.45	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.

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. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

E. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

F. 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 EXECUTION

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 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.

3.3 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 with 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.

3.4 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.

3.5 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 en temperature is 35 degrees waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

3.6 F and rising. Take temperature readings in

A. 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.

B. 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.

C. 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.

D. 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 and/or County.

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

SECTION 33 06 40.10

HDPE SOLID AND PROFILE WALL PIPE

PART 1 GENERAL

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. 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. 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. Owner's Representative reserves right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve manufacturer of responsibilities 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 PRODUCTS

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	8 - 60

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	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.
following information:

1. Pipe size.
2. Pipe class.
3. Production code.
4. Material designation.

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

PART 3 EXECUTION

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

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

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. Stipulated Price (Lump Sum). Contract is a 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 toavoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to locationof 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 PRODUCTS

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 EXECUTION

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 GENERAL

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. 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. 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 PRODUCTS

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 EXECUTION

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

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Portland cement concrete paving.

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 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. ASTMC494 -Standard Specification for Chemical Admixtures for Concrete.

T. ASTMC618 -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 PRODUCTS

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:

	Percent by Weight of Total Sample

Item	Maximum
Clay lumps and friable particles Material finer than 75-um (No. 200) sieve: Concrete subject to abrasion All other concrete	3.0 3.0* 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-pm (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 1%" sieve	0
Retained on 1%" sieve	0 to 5
Retained on %" 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:

E.

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.

F. 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.

G. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

H. 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.

I. 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

2.3 Conform Equipment to requirements of ASTM C 94.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 EXECUTION

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. Concrete Finishing

Surface	Finish	Thickness	Strength
Sidewalks	Broom, Medium	4 1/2”	3,000 psi
Parking	Broom, Heavy	5”	3,500 psi
Drives	Broom, Heavy	6”	3,500 psi

D. 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.

E. 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.

1. 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 inplace 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 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.

3.16 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 PAVING CURING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

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 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 PRODUCTS

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 EXECUTION

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

SECTION 32 13 13.25

CONCRETE SIDEWALKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

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 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 PRODUCTS

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 EXECUTION

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 GENERAL

1.1 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.2 MEASUREMENT AND PAYMENT

A. 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 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 PRODUCTS

2.1 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.2 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.3 JOINT SEALING COMPOUND

A. 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 EXECUTION

3.1 PLACEMENT

A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling, or cracks.

3.2 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.3 EXPANSION JOINTS

A. Place 3/4 inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart 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 91 13.13

TOPSOIL PLACEMENT AND GRADING

PART 1 GENERAL

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. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS

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 EXECUTION

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 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section pertains to the establishment of vegetative cover by Hydromulching or Sodding as indicated on the drawings and as specified herein.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 REGULATORY REQUIREMENTS

A. Contractor shall comply with all current, applicable codes and regulations.

B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.

C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.4 SUBMITTALS

A. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.

B. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 QUALITY ASSURANCE

A. Install lawns only when weather and soil conditions are deemed by the Owner’s Representative to be suitable for proper placement. Do not install lawns during rainy or freezing weather, or when soil is frozen.

1.6 MAINTENANCE SERVICE

A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
   1. Seeded Lawns: 90 days from date of planting completion.
      a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.
   2. Sodded Lawns: 30 days from date of planting completion.

B. Reseed or Resod unacceptable areas.

1.7 WARRANTY

A. Time Period: Warrant that lawns are in healthy and flourishing condition of vigorous active growth one year from date of Final Acceptance.

B. Appearance During Warranty: Lawns shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.

C. Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or Acts of God during Warranty Period. Report such conditions in writing.

PART 2 - PRODUCTS

2.1 LAWN SEED

A. 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 (Lb/Ac)	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

B. 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

C. 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.

D. Soil Stabilizer: "Terra Tack 1" or approved equal.

E. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

2.2 LAWN SOD

A. Species: St. Augustine (Stenotaphrum Secundatum) Gulf Coast variety to match existing sod or as indicated on the Drawings.

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.
1. Sod shall be rejected if found to contain any amount of the following weeds:
   a. Quackgrass.
   b. Johnson grass.
   c. Poison ivy.
   d. Nimbleweed.
   e. Thistle.
   f. Bindweed.
   g. Bentgrass.
   h. Perennial sorrel.
   i. Bromegrass.

C. Size: 12 inch wide strips, uniformly 2 inches thick with clean-cut edges. Rhizome development should be apparent.

D. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.

2.3 TOP DRESS FERTILIZER

A. (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to the derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:
1. 16% Nitrogen
2. 6% Phosphoric Acid
3. 8% Potash

2.4 WEED AND INSECT TREATMENT

A. Provide acceptable treatment to protect sod from weed and insect infestation. Submit treatment method to Project Manager for approval. Install insect and disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.

2.5 WATER

A. Potable, available on-site through Contractor's water trucks.

2.6 BANK SAND

A. Free of clay lumps, roots, grass, salt or other foreign material.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that grades are within 1-inch plus or minus the required finished grades. Verify that all soil preparation has been completed and approved. Report all variations in writing.

B. Stones, Weeds, Debris: Verify that all areas to receive lawns and grasses are clear of stones larger than 1-1/2 inch in diameter, weeds, debris, and other extraneous materials.

C. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.2 SODDING

A. Sod Bed Preparation:
1. Rolling: Roll amended soil with 200 pound water-ballast roller.
2. Moistening Soil Surface: After all unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.
3. Timing: Sod immediately thereafter, provided the sod bed has remained in friable condition.

B. Sodding Operations :
1. Big roll sod shall be installed by tractors with proper flotation tires of by an approved big roll sod installation machine. Care should be taken to roll out sod at a proper speed so that no humping or tearing of sod occurs. Sod will be manually pulled together by stiff rakes to insure no gaps remain in the seams. Joints should be staggered. Damaged or problem areas shall be cut out and replaced in a professional matter.
2. Starter Strip:
   a. Lay first row of sod in a straight line, with subsequent rows parallel to and tightly against each other.
   b. Stagger lateral joints.
   c. Do not stretch or overlap sod.
   d. Butt all joints tightly to eliminate all voids.
3. Cutting: Use a sharp knife to cut sod to fit curves, surface components of the irrigation system or other items.
4. Tamping and Rolling: Thoroughly tamp and roll sod to make contact with sod bed. Roll each entire section of completed sod.

5. Watering: Thoroughly water sod immediately after installation to wet the underside of the new sod pad and the soil immediately below to a depth of 6 inches. Maintain constant moisture for 2 weeks or until sod is fully rooted.
6. Top-Dress Fertilizer: Apply at the rate of (6) to (8) pounds per 1,000 square feet at 25 days and at 50 days after sodding.

3.3 HYDROMULCH SEEDING

A. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient of agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Engineer may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

B. Mixing: Care shall be taken that the slurry preparation should be accomplished per the material supplier's recommendations and the equipment manufacturer's written operations manual. Spraying shall commence immediately when the slurry is mixed and the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

C. Application:
1. Contractor shall obtain approval of hydromulch area preparation from the Engineer prior to application.
2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
3. Keep hydromulch within areas designated and keep from contact with other plant material.
4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.
5. After application, the Contractor shall not operate any equipment over the covered area.
6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.
7. All areas designed on drawings shall be covered uniformly with specified materials using hydromulching processes. If surfaces remain uncovered within the designated area, the Contractor shall make additional applications of specified hydromulch planting to bare areas not meeting specified coverage as determined by the Owner's Representative. Such replanting to be performed immediately upon notification by the Owner's Representative.

3.4 MAINTENANCE

A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.

B. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
   1. Seeded Lawns: 90 days from date of planting completion.
      a. For areas seeded in fall or if lawn is not fully established, continue maintenance following spring until acceptable lawn is established.
   2. Sodded Lawns: 30 days from date of planting completion.

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 hydromulch.

E. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing.

3.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:
   1. For Seed: Ninety Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.
   2. For Sod: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. The Owner's Representative shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

END OF SECTION 32 92 00

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

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. 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. 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 (Nonshrink)

I. ASTM D 698 -Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/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 PRODUCTS

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 EXECUTION

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 nonshrink 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 0513

SECTION 33 05 16.13

PRECAST CONCRETE UTILITY STRUCTURES

PART 1 GENERAL

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. 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 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 PRODUCTS

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 EXECUTION

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

SECTION 33 05 16.16

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 GENERAL

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. 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. 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- StandardSpecification for Chemical Admixtures for Concrete.

FF. ASTM C 595- StandardSpecificationfor Blended Hydraulic Cements.

GG. ASTM C 685- StandardSpecification for Concrete Made by Volumetric Batchingand 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 PRODUCTS

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.

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.

1. Fiber: Fibrillated Polypropylene Fiber:
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 Minimum Average Tensile Strength: 50,000 psi 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

6) 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.

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			
A	Structural	3200	4000	0.45	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.

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. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

E. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

F. 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 EXECUTION

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 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.

3.3 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 with 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.

3.4 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.

3.5 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 en temperature is 35 degrees waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

3.6 F and rising. Take temperature readings in

A. 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.

B. 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.

C. 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.

D. 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 and/or County.

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

SECTION 33 06 40.10

HDPE SOLID AND PROFILE WALL PIPE

PART 1 GENERAL

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. 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. 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. Owner's Representative reserves right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve manufacturer of responsibilities 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 PRODUCTS

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	8 - 60

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	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.
following information:

1. Pipe size.
2. Pipe class.
3. Production code.
4. Material designation.

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

PART 3 EXECUTION

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

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

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. Stipulated Price (Lump Sum). Contract is a 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 toavoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to locationof 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 PRODUCTS

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 EXECUTION

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 GENERAL

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. 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. 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 PRODUCTS

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 EXECUTION

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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