

PROJECT  
MANUAL  
**VOLUME 1**

JANUARY 20, 2025



**2024 Cy-Creek HS Renovations**  
**CYPRESS-FAIRBANKS ISD**  
**HOUSTON, TEXAS**

OWNER:



INDEPENDENT SCHOOL DISTRICT

11440 Matzke Rd.

Cypress, Texas 77429

VLK Project No.

23-148.00

Cypress-Fairbanks  
Project No.  
24-02-5754-R-RFP





OWNER

**Cypress-Fairbanks  
Independent School District**

11440 Matzke Rd.

Cypress, Texas 77429

ARCHITECT

**VLK**

Rudy Starks, NCARB

20445 SH 249, Suite 350

Houston, Texas 77070

Main Phone: 281.671.2300

[www.vlkarchitects.com](http://www.vlkarchitects.com)



01/20/2025

CIVIL ENGINEER

**Brooks & Sparks, Inc.**

Firm Registration Number: F-880

Frank Brooks, P.E.

21020 Park Row Drive

Katy, Texas 77449

Main Phone: 281.578.9595

[www.brooksandsparks.com](http://www.brooksandsparks.com)



01/20/25

STRUCTURAL ENGINEER

**Dunaway Associates**

Firm Registration Number: F-1114

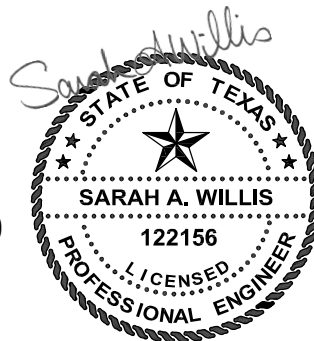
Sarah Willis, PE

5707 Southwest Pkwy, Bldg. 2, Ste. 250

Austin, Texas 78735

Main Phone: 512.306.8252

[www.dunaway.com](http://www.dunaway.com)



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FOOD SERVICE

**FDP, LLC**

25317 Interstate 45  
Woodlands, Texas 77380  
Main Phone: 281.734.5404  
[www.FDP.org](http://www.FDP.org)

ACOUSTICAL / THEATRICAL

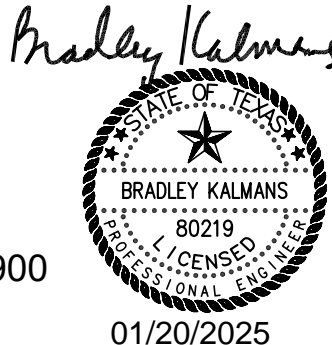
**WJHW, Inc.**

2000 W Loop S, Suite 1340  
Houston, Texas 77027  
Main Phone: 972.934.3700  
[www.wjhw.com](http://www.wjhw.com)

MEP ENGINEER

**Salas O'Brien**

Firm Registration Number: F-4111  
Bradley Kalmans, P.E.  
10930 W. Sam Houston Pkwy N, Suite 900  
Houston, Texas 77064  
Main Phone: 281.664.1900  
[www.salasobrien.com](http://www.salasobrien.com)



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**2024 Cy-Creek HS Renovations**  
**CYPRESS-FAIRBANKS ISD**  
**HOUSTON, TEXAS**

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Project No.  
24-02-5754-R-RFP

## LANDSCAPE

### Westwood

Bradley Bennett, PLA  
20329 State Hwy 249, #350  
Houston, Texas 77070  
Main Phone: 281.883.0103  
westwoodps.com



## PROJECT MANUAL VOLUME 1

JANUARY 20, 2025

# 2024 Cy-Creek HS Renovations CYPRESS-FAIRBANKS ISD HOUSTON, TEXAS

VLK Project No.

23-148.00

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**VOLUME 1**

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**PROCUREMENT REQUIREMENTS**

Document AA - Request for Competitive Sealed Proposals  
AB - Instructions to Offerors  
AC - Base Proposal  
    Alternate Proposal  
AD - Proposal Bond  
AE - Felony Conviction Notification  
AF - List of Subcontractors  
AG - Proposal Evaluation Waiver  
AH - Affidavit of Non-Discriminatory Employment  
AI - Waiver and Release of Lien Forms  
AJ - Warranty Certificate  
AK - Affidavit of Non-Asbestos, Lead, and PCB Use in Project  
AL - Certification of Project Compliance  
AM - Request for Clarification During Proposal Process  
AN - Conflict of Interest Questionnaire  
AO - Project Close Out  
AP - Certification of Criminal History Record Information  
AQ - Certificate of Final Completion  
AR - Disclosure of Interested Parties

**CONTRACTING REQUIREMENTS**

Document BA - Contract Documents  
    - Standard Form of Agreement Between Owner and Contractor (AIA Document A101-2017)  
    - General Conditions of the Contract for Construction (AIA Document A201-2017)  
BB - Texas Statutory Performance Bond  
BC - Texas Statutory Payment Bond  
BD - Insurance and Bonds Requirements for Contractors and Facility Renters  
CA - Application and Certificate for Payment Checklist and Transmittal  
CB - Supplementary Conditions  
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CC - Right of Audit - Examination of Records

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01 45 00 - Quality Control  
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01 57 23.11 - Stabilized Construction Exit  
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07 42 13 - Prefinished Metal Wall Panels  
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10 12 00 - Display Cases  
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10 28 00 - Toilet Accessories  
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## **DIVISION 14 - CONVEYING EQUIPMENT**

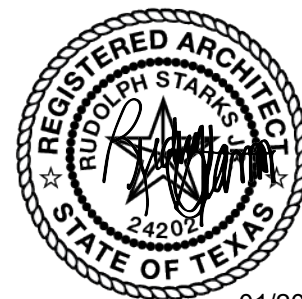
NONE IN THIS PROJECT

**DIVISIONS 15 through 20** - Not used.



## **DIVISION 21 - FIRE SUPPRESSION**

- Section 21 01 00 - Fire Protection Operating and Maintenance Manuals  
21 05 00 - Fire Protection General Provisions  
21 05 10 - Fire Protection Contract Quality Control  
21 05 12 - Fire Protection Shop Drawings, Coordination Drawings & Product Data  
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## **DIVISION 22 - PLUMBING**

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22 05 00 - Plumbing General Provisions  
22 05 10 - Plumbing Contract Quality Control  
22 05 12 - Plumbing Shop Drawings, Coordination Drawings & Product Data  
22 05 13 - Electrical Provisions of Plumbing Work  
22 05 14 - Plumbing Alterations Project Procedures  
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22 05 17 - Plumbing Access Doors  
22 05 19 - Pressure and Temperature Instruments  
22 05 23 - Valves, Strainers and Vents  
22 07 19 - Plumbing Piping Insulation  
22 08 00 - Plumbing Systems Technical Commissioning Requirements  
22 11 16 - Domestic Water Piping and Appurtenances  
22 11 23 - Domestic Water Pumps  
22 13 16 - Soil, Waste and Sanitary Drain Piping  
22 14 13 - Roof Drainage  
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22 63 11 - Gas Piping and Appurtenances

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23 05 17 - HVAC Access Doors  
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23 05 19 - HVAC Pressure and Temperature Instruments  
23 05 23 - HVAC Valves, Strainers and Vents  
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23 05 93 - Testing, Balancing and Adjusting (TAB) of Environmental Systems  
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23 36 16 - Variable Volume Terminal Units  
23 36 17 - Dual Duct Variable Volume Terminal Units  
23 37 13 - Air Devices  
23 41 00 - Air Filtration  
23 65 27 - Air-Cooled Rotary Scroll Chiller  
23 73 13 - Air Handling Units  
23 82 16 - Heating and Cooling Coils  
23 82 18 - Ductless Mini Split Dx Units  
23 82 41 - Electric Duct Heaters

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## **DIVISION 26 - ELECTRICAL**

- Section 26 01 05 - Electrical Operating and Maintenance Manuals  
26 05 00 - Electrical General Provisions  
26 05 05 - Electrical Alterations Project Procedures  
26 05 10 - Contract Quality Control  
26 05 12 - Electrical Shop Drawings, Coordination Drawings & Product Data  
26 05 19 - Conductors and Connectors – 600 Volt  
26 05 26 - Electrical Grounding  
26 05 27 - Expansion of Electrical Grounding  
26 05 33 - Conduit Systems  
26 05 35 - Electrical Connections for Equipment  
26 05 37 - Electrical Boxes and Fittings  
26 05 40 - Electrical Gutters and Wireways  
26 05 50 - Firestops  
26 08 00 - Electrical Commissioning Coordination  
26 09 25 - Electrical Contactors  
26 09 28 - Digital Lighting Control System  
26 12 17 - Ultra High Efficiency K-Rated Transformers  
26 24 13 - Switchboards  
26 24 14 - Testing Maintenance, Modifications to Existing Switchboards  
26 24 16 - Panelboards and Enclosures  
26 24 25 - Enclosed Switches and Circuit Breakers  
26 24 30 - Fuses  
26 27 73 - Line Voltage Wiring Devices  
26 43 00 - Surge Protection Devices  
26 51 13 - Lighting Fixtures  
26 55 61 - High School Auditorium and Blackbox Theatrical Lighting System  
26 56 67 - Sports Field Lighting System

## **DIVISION 27 - COMMUNICATIONS**

- Section 27 01 00 - Operating and Maintenance (O&M) Manuals of Communications Systems  
27 05 00 - Communications Basic Materials, Methods and General Provisions  
27 05 07 - Communications Shop Drawings, Coordination Drawings & Product Data  
27 05 09 - Contract Quality Control  
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27 10 00 - Structured Cabling System (SCS)  
27 41 16 - Integrated Audio/Video Systems and Equipment  
27 41 16.20 - Local Sound Reinforcement Systems  
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## **DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

- Section 28 01 00 - Electronic Safety and Security Operating and Maintenance Manuals  
28 05 00 - Electronic Safety and Security Basic Materials, Methods and General Provisions  
28 05 07 - Shop Drawings, Coordination Drawings & Product Data  
28 05 10 - Contract Quality Control  
28 05 50 - Firestops  
28 10 00 - Access Control System (ACS)  
28 10 00.05 - Audio / Video Intercom (IP)  
28 20 00 - Video Surveillance System (VSS)  
28 31 00 - Intrusion Detection System (IDS)  
28 46 00 - Fire Detection and Alarm System  
28 55 00 - RF Survey for In-Building Emergency Responder Radio Coverage (ERRC) And Testing of Existing ERRC Enhancement Systems (EERCES)



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**DIVISIONS 29 and 30** - Not used.

## **DIVISION 31 - EARTHWORK**

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31 06 20.17 - Utility Backfill Materials  
31 11 00 - Clearing and Grubbing  
31 22 00 - Grading  
31 23 00 - Excavation and Backfill for Structures  
31 23 16.14 - Trench Safety System  
31 23 33 - Trenching and Backfilling  
31 31 00 - Soil Treatment  
31 63 29 - Drilled Concrete Piers

## **DIVISION 32 - EXTERIOR IMPROVEMENTS**

- Section 32 11 13.13 - Lime-Treated Subgrades  
32 11 16 - Graded Stone Base  
32 11 29.13 - Lime-Fly Ash-Treated Base Courses  
32 13 13 - Concrete Paving  
32 13 13.10 - Concrete Pavement Curing  
32 13 13.25 - Concrete Sidewalks  
32 13 73 - Concrete Paving Jointing  
32 16 13 - Curbs and Gutters  
32 17 23 - Pavement Markings  
32 18 13 - Synthetic Grass Surfacing  
32 18 14 - Paved Elastic Layer  
32 18 23.39 - Synthetic Running Track Surfacing  
32 18 23.50 - Polyurethane Full Depth Track Surface  
32 18 23.59 - Synthetic Tennis Court Surfacing  
32 18 23.60 - Track Striping  
32 18 30 - Infilled Synthetic Turf System  
32 31 13 - Chain Link Fences and Gates  
32 31 13.26 - Chain Link Fences - Tennis Courts  
32 31 19 - Decorative Metal Fences and Gates  
32 84 00 - Planting Irrigation  
32 91 13.13 - Topsoil Placement and Grading  
32 92 13 - Hydro-Mulching  
32 92 23 - Sodding



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## **DIVISION 33 - UTILITIES**

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33 05 13.13 - Manhole Grade Adjustment  
33 05 16.13 - Precast Concrete Utility Structures  
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33 06 40.10 - HDPE Solid and Profile Wall Pipe  
33 06 40.11 - Reinforced Concrete Pipe  
33 11 00 - Water Utility Distribution Piping  
33 11 00.10 - Augering for Water Utility Distribution Piping  
33 12 13.10 - Tapping Sleeves and Valves  
33 12 13.12 - Wet Connections  
33 12 16 - Water Utility Distribution Valves  
33 12 40 - Valve Boxes, Meter Boxes, and Meter Vaults  
33 12 50 - Fire Hydrants  
33 13 00 - Disinfecting of Water Utility Distribution  
33 13 00.10 - Hydrostatic Testing of Pipelines  
33 31 00 - Sanitary Utility Sewerage Piping  
33 31 00.10 - Acceptance Testing for Sanitary Sewers  
33 41 00 - Storm Utility Drainage Piping  
33 49 13 - Storm Drainage Manholes, Frames, and Covers

**DIVISIONS 34 through 49 - Not used.**

**DOCUMENT AA**

**REQUEST FOR COMPETITIVE SEALED PROPOSALS**

Competitive Sealed Proposals for the work described 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, Cypress-Fairbanks 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:** Cypress-Fairbanks Independent School District  
11440 Matzke Rd.  
Cypress, Texas 77429  
Representative: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction

**ARCHITECT:** VLK Architects  
20445 SH 249, Suite 350  
Houston, Texas 77070  
Representatives: Rudy Starks

**PROJECT:** **2024 Cy Creek HS Renovation**  
CFISD Proposal Number: 24-02-5754-R-RFP

**LOCATION:** **9815 Grant Rd., Houston, Texas 77070**

**PROPOSED CONSTRUCTION BUDGET:** **\$ 23,454,377.59**

**PRE-PROPOSAL  
CONFERENCE:** **Wednesday, January 29, 2025, at 10:00 AM** at Cypress-Fairbanks Independent School District, Facilities & Construction Conference Room, 11430-B Perry Road, Houston, Texas 77064. Representatives of the Architect and Owner will be present at this meeting. All offerors are encouraged to attend.

**PROPOSAL DATE  
AND TIME:** **Thursday, February 13, 2025** Base Proposal: 2:00 PM  
Alternate Proposal: 3:00 PM

**LOCATION OF  
PROPOSAL  
OPENING:** Cypress-Fairbanks Independent School District  
Facilities and Construction  
11430-B Perry Road  
Houston, Texas 77064  
(281) 897-4108

Proposal Documents will be available on/after **Monday, January 20, 2025**. General Contractor Offerors may obtain two (2) sets of drawings and specifications at the place identified below upon deposit of **\$650.00** per set with check made payable to **Architect**. The deposit will be returned when the Plans and Specifications are returned in good condition. Additionally, General Contractor Offerors must submit of a fully executed AIA Document A305, Contractor's Qualification Statement to the office of the Architect at the time proposal documents are obtained.

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

ISqFt Plan Room (AGC)  
8450 Westpark, Ste. 100  
Houston, Texas 77063  
Ph: (713) 843-3700 Fx: (713) 843-3701

McGraw-Hill Construction/ Dodge Data & Analytics  
www.dodgeplans.construction.com or contact Toni.Lawson@construction.com Ph: (281) 460-5730

Office of **VLK Architects**

**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 the opening of proposals.

**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 the hands of the Owner no later than the time specified above. Please seal all proposals in duplicate in an envelope with the following information on the face of the envelope.

Name of Offeror (General Contractor)  
**2024 Cy Creek HS Renovation**  
Cypress Fairbanks Independent School District  
Cypress-Fairbanks I.S.D. Proposal Number: **24-02-5754-R-RFP**  
\_\_\_\_\_(Name of Bonding Company)  
Attn: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction

The Owner reserves the right to reject any and all proposals and to waive any informality in the Competitive Sealed Proposal process. No proposal shall be withdrawn within sixty (60) days after the proposal opening without the specific consent of the Owner. Refer to Offerors Section Document AB.

**SELECTION CRITERIA:** Selection criteria are included in Document AB of the Project Manual and Selection Criteria and are available on request by perspective Offerors from the office of the Architect.

**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 proposed 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. Refer to Section AB, Instructions to Offerors for detailed Bond requirements.

The prevailing rates of wages as stipulated in the Supplementary Conditions here within are the minimums that must be paid in conformance with all applicable laws of the State of Texas.

All Offerors (General Contractors) submitting proposals are encouraged to attend the proposal opening and visit the Project site.

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. The subcontractor/supplier is responsible for all the associated work and coordination when not obtaining a complete set of drawings.

**END OF DOCUMENT**





## DOCUMENT AB

### INSTRUCTIONS TO OFFERORS

#### 1. QUALIFIED OFFERORS

- A. Proposals will be accepted from qualified General Contractors only for the entire scope of work described in the Contract Documents. As a prerequisite to a Contractor's qualifying for the award of contract on this work, the Contractor must complete each item of the Contractor Information and Experience Statement (AIA Document A305<sup>TM</sup>). The Statement forms may be obtained from the office of the Houston Chapter of the American Institute of Architects (A.I.A), 315 Capitol, Suite 120; Houston, TX 77002. The Statement and 3 references of similar projects with current/verified phone numbers, email address and current/verified fax numbers for references of Owner and Architect (refer to Exhibit A on page 9), shall be submitted to the Architect by **5:00P.M. CST on Monday, February 3, 2025**.
- B. Every interested Offeror shall be required to submit AIA Document A305<sup>TM</sup> (Contractor's Information and Experience Statement) to Architect. AIA Documents submitted by fax transmission will not be accepted.
- C. The primary purposes of the evaluation process will be to:
  - 1. Gather information for the Owner's evaluation procedure.
  - 2. Enable the Architect to evaluate the Contractor's qualifications and determine which Contractors the Architect could recommend to the Owner should such recommendation be requested by the Owner.
- D. After completion of the Contractor evaluation process, the Architect will notify the Owner and each Contractor who has submitted a Contractor's Qualification Statement as to the Architect's opinion. In the event the Owner chooses to determine the acceptability of Contractors prior to receipt of Proposals, the Contractors will be notified of the Owner's decision prior to the proposal date, otherwise the Owner will make his decision after receipt of proposals.
- E. In arriving at his opinion concerning the Contractor's qualifications, the Architect will use the same criteria that the Owner will use in determination of the successful Contractor as detailed hereinafter.
- F. In the event an Offeror fails to submit the specified Contractor's Qualification Statement in accordance with the schedule established, such noncompliance shall be considered by both the Owner and Architect as a negative factor in the determination of the successful Offeror.
- G. In the event the Architect notifies a Contractor that it is the Architect's opinion the Contractor has not sufficiently demonstrated his qualifications to perform the subject Contract, taking into consideration the items listed under Paragraph 19.A and the Contractor subsequently decides to submit a Proposal, the Contractor shall be doing so with the knowledge that the Architect will not recommend him as a qualified Offeror.

#### 2. OFFEROR'S PRESENTATION

Each Offeror by making their Proposal represents that:

- A. The Offeror has read and understands the Proposal Documents and their Proposal is made in accordance therewith.
- B. The Offeror has visited the site, has familiarized themselves with the local conditions under which the work is to be performed and has correlated their observations with the requirements of the proposed Contract Documents.

- C. The Offeror agrees to comply with the requirements of the following paragraph. These requirements are absolute, and any Offeror who subsequently does not agree to comply with these requirements will automatically disqualify himself from proposing or receiving award of the contract.
- D. The Offeror agrees that:
  - 1. Work on the project will begin immediately upon the General Contractor's receipt of CFISD's Notice to Proceed. The NTP will be accompanied by CFISD's purchase order.
  - 2. On-site mobilization will not begin until after the Bonds and Certificate of Insurance have been reviewed and approved by the Owner and that timely submittal of correct Bonds and Certificate of Insurance is solely the responsibility of Offeror.
  - 3. Offeror will participate as a team member in cooperation with the Owner and Architect.
  - 4. The Offeror will assign competent full-time superintendents and that these superintendents shall be maintained on the project for the duration of the project including completion of all punch list items, subject only to their continuous employment.
  - 5. The Offeror will furnish and pay for a proposal bond in the amount of ten percent (10%) of the greatest amount proposed.
  - 6. If awarded, the Offeror shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount.
  - 7. Offeror and its subcontractors shall comply with requirements listed in Document BD, Insurance and Bonds Requirements for Contractors and Facility Renters.
  - 8. Each Offeror by making their Proposal represents that their Proposal includes only material and equipment specified in the Proposal Documents and supplemented, if necessary, for a complete and operating system.
  - 9. Each Offeror by making their Proposal represents that their Proposal includes the employment of Subcontractors that meet or exceed the Installer Qualifications described in the Project Manual.
  - 10. Each Offeror (and sub-Offeror or supplier submitting a proposal to an Offeror) shall submit an affidavit stating that no asbestos, PCBs or lead building materials will be incorporated into the Work.

### **3. PROPOSAL DOCUMENTS**

- A. Proposal Documents include the Proposal Forms, Contract Forms, Specifications, Drawings, Addenda and documentation as noted in AIA Document A201<sup>TM</sup>-2017, as amended.

### **4. INTERPRETATION OF PROPOSAL DOCUMENTS**

- A. Offerors and sub-Offerors requiring clarification or interpretation of the Proposal Documents shall make a written request using the form bound in the Project Manual, 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.

### **5. 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 ten (10) days prior to the date for receipt of proposals. 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.

## **6. ASBESTOS, LEAD AND PCB CONTAINING MATERIALS, PRODUCTS AND SYSTEMS**

- A. The use of asbestos or PCB's in any construction process is strictly prohibited
- B. Prior to submitting a proposal, Offerors shall notify the Architect, in writing, of any materials, products and systems in these specifications which are known to contain or are likely to contain asbestos, lead or PCBs. The Architect will promptly explore possibilities for selecting other materials, products and systems which would circumvent the problem and notify Offerors of any changes in an addendum, otherwise it will be understood that only specified materials, products and systems that are asbestos, lead, and PCB free are included in the proposals.
- C. Prior to payment of Retainage and Final Payment, the Contractor and all subcontractors shall furnish a notarized statement certifying that no asbestos/PCB's, or asbestos/PCB-containing materials have been used in this Project.

## **7. INSURANCE**

- A. Each Offeror shall include in his proposal the complete cost for insurance required under the Amended General Conditions, Supplementary Conditions and Specification Document BD, Insurance and Bond Requirements for Contractors and Facility Renters. Coverage shall remain in full force for the duration of the Project.

## **8. PERFORMANCE BOND AND PAYMENT BOND**

- A. Each Offeror shall include in his base proposal, the premium costs for 100% Performance Bond and 100% Payment Bond. Bonds shall be written by a Surety Company included in the latest State Board of Insurance, Bond Department's "List of Insurance Companies Licensed to Write Fidelity and Surety Bonds in Texas, and the latest United States Department of the Treasury's Listing of Approved Sureties (Department Circular 570). The Owner reserves the right to make inquiries about the current financial stability of the Surety, including demands for proof of sound reinsurance, proof that claims are being met, and current financial information. The Owner reserves the right to reject Bonds written by a Surety that, in the Owner's judgment, does not provide proof of sound reinsurance and or does not provide proof that claims are being met.

## **9. 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 transmitted to each person or firm recorded by the Architect as having received the proposal documents in accordance with the Request for Competitive Sealed Proposals, and will be available for inspection wherever the proposal documents are available for that purpose.
- D. Proposals must be submitted in duplicate and only on the Proposal Forms included in the Project Manual, in sealed envelopes addressed as follows:

Name of Offeror (General Contractor)  
*Competitive Sealed proposal for:*  
2024 Cy Creek HS Renovation  
Cypress-Fairbanks Independent School District  
Cypress-Fairbanks ISD Proposal Number: 24-02-5754-R-RFP  
\_\_\_\_\_  
*Name of Bonding Company*  
Attn: Mr. Jesse Clayburn, Assistant Supt. of Facilities and Construction  
Facilities, Planning & Construction  
11430-B Perry Road  
Houston, Texas 77064

- E. All proposals must be delivered sealed to the above address stipulated in the Request for Competitive Sealed Proposals at or before the time and date set. Proposals will be received at no other place. If Proposal is sent by U.S. Mail, it must be sent Registered Mail.
- F. 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. Conditional proposals will not be accepted. Award may be made to other than the low-dollar Offeror and given to 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.
- G. A proposal may be withdrawn only upon request by the Offeror or his duly authorized representative, provided such written request is received by the Owner at the place designated for receipt of proposals and prior at least forty-eight (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 sixty (60) days.

## 10. SUBMISSION OF ADDITIONAL PROPOSAL INFORMATION

- A. The Offeror shall submit with his Alternate Proposals:
  - 01 Proposal Form AC Alternates
  - 02 An experience profile (resume) of the proposed superintendent(s) and project manager(s). These experience profiles will be considered by the Selection Committee in the evaluation of the Offeror’s proposal.
  - 03 The firm names of the major subcontractors and/or suppliers requested on the Alternate Proposal Form AF.
  - 04 Signed and Notarized Special Owner Requirements Sections 01 35 23 and 01 35 23.1.
  - 05 An experience profile (resume) of the Offeror, including a list of projects completed of similar size and scope. These experience profiles will be considered by the Selection Committee in the evaluation of the Offeror’s proposal.

## 11. FELONY CONVICTION NOTIFICATION

- A. Each Offeror shall execute and submit Form AE, Statement of Affirmation within the sealed envelope containing the Base Proposal.

- B. 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”.

## 12. PROPOSAL EVALUATION WAIVER

- A. Each Offeror shall execute and submit Form AG, Proposal Evaluation Waiver within the sealed envelope containing the Base Proposal.
- B. All Offerors shall agree to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The Offeror further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, with regards to acceptance or rejection of any proposals, and recommendation or award of the contract.

## 13. AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

- A. Each Offeror shall execute and submit Form AH, Affidavit of Non-Discriminatory Employment within the sealed envelope containing the Base Proposal.
- B. All Offerors, Contractor and subcontractors 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.

## 14. CONFLICT OF INTEREST QUESTIONNAIRE

- A. Each Offeror shall execute an on-line Conflict of Interest Questionnaire and submit Form AN within the sealed envelope containing the Base Proposal.

## 15. 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 acceptable Performance Bond, Payment Bond and Certificates of Insurance by the successful Offeror within ten (10) days after notification of award to such Offeror and that this proposal will not be withdrawn within sixty (60) days after date of opening of proposals without the consent of the Owner. Proposal Bond shall be submitted on AIA Document A310™-2010 or on Form AD included in the Project Manual.
- B. Proposal Security shall be submitted within the sealed envelope containing Alternate Proposals.
- C. Withdrawal of a proposal by an Offeror, or refusal to enter into negotiations and/or acceptance of a contract for construction by an Offeror after the opening of proposals and within and including the sixtieth day after proposals shall subject the Offeror to the forfeiture of his proposal security to the Owner.

## 16. SUBMISSION OF POST PROPOSAL INFORMATION

- A. Each Offeror shall submit, by **5:00P.M. the next business day following the bid opening**, following documentation to the office of the Architect. The post proposal information submitted by the Offeror will be considered by the Selection Committee in the evaluation of the Offeror's proposal:
1. A bar-chart construction schedule delineating construction phasing including major construction milestone dates.
  2. A statement describing the Offeror's proposed management concept for the Project.
  3. A statement of all Work to be self-performed by the Offeror.
  4. Complete and fully executed Contractor Qualification Statement Form, AIA Document A305, for each of the subcontractors named on the Offeror's Alternate Proposal Form. Qualification statements must include a listing of past projects performed by the subcontractor that are of similar size and scope to the Project. Past project information must include the names and telephone numbers of the respective Owner's and Architect's representatives for those projects.
  5. Any voluntary Value Engineering items that the proposer would believe to be of interest to the Owner. (This VE list will not be considered part of the evaluation process and is entirely voluntary.)
  6. As part of post proposal negotiations the Owner may desire to discuss a voluntary option that would establish the amount to be added to the owner's contingency allowance as an incentive amount offered by the general contractor and identified sub-contractors for early payments made by the owner to the general contractor on or before the 15th day of each month following the specified billing period. In addition, General Contractor agrees to maintain timely payments to subcontractors upon payment to the general contractor by the owner. This incentive is made to the owner as a lump sum for each trade contract participating, the proposed amount offered is for the duration of the contract and shall be allocated on a percentage complete of total contract value per month per contractor or subcontractor offering the incentive for early payment. The amount of the incentive each month shall be the proposed value by trade for the incentive multiplied by the percentage completed that month of that trade or generals total contract, if the owner makes payment to the general contractor on or before the 15th day of the month following the billing period then the incentive would be recognized as a credit to the owners contingency allowance, if the payment is not made on or before the 15th by the owner then the incentive credit to the Owner that month would not be applied.  
  
A value for this incentive for the general contractor and the proposed list of subcontractors and values proposed for each that want to participate in this option will be submitted by the highest ranked proposer during post proposal negotiations.
- B. The selected Offeror shall execute From AL, Certification of Project Compliance, and submit at Project Closeout.
- C. The selected Offeror shall execute and submit Form AP, Certification of Criminal History Record Information within 10 days after receipt of Notice to Proceed and prior to commencement of Work.

## 17. 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, irregular, or not submitted by the published date and time as specified.

## 18. EVALUATION OF PROPOSALS

- A. The Owner may discuss proposals with Offerors after the proposal opening, to allow for clarification.

- B. The Owner shall endeavor to prevent non-monetary information from competing proposals being disclosed to other Offerors.
- C. The Owner will, within forty-five (45) days after the proposal opening, evaluate and rank each proposal submitted relative to the selection criteria.
- D. The Owner's Selection Committee will select the Offeror that offers the best value based on the selection criteria and the Selection Committee's ranking of the proposals.
- E. The Owner and Architect may discuss options with the selected Offeror for cost reduction and/or other Contract terms. If the Owner is unable to come to terms with the first ranked Offeror, discussions are to terminate and the Owner will proceed to the next ranked Offeror and repeat the process until a contract agreement is reached or all proposals are rejected.

#### 19. DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

- A. In determining the Selected Offeror, the Owner will evaluate the information derived from the Offeror's (Contractor's) Qualification Statement, information received from completed Offeror's reference surveys, direct experience with the Offeror by Selection Committee members, the Offeror's proposal including information requested with the proposals and post proposal information submitted by the Offeror relative to the following Selection Criteria. A maximum of **one hundred twenty (120) points** may be scored to each proposal.

1.	Purchase Price – The purchase price will be scored mathematically as a weighted percentile score utilizing the proposal submitted and the weighted value of the criterion	40
2.	Reputation – Offeror and the Offeror's goods and services for projects of similar size and scope	10
3.	Quality – Offeror and the Offeror's goods and services for projects of similar size and scope	10
4.	Completion – Offerors past record of completing projects of similar size and scope on time and within budget	10
5.	Warranty – Offeror's response to warranty work requests, the quality of the warranty work, and the Offeror's record of monitoring and reporting back to the Owner on the progress of warranty work	10
6.	Close Out – Offeror's record of closing out projects expeditiously	10
7.	Project Team – The qualifications of the Offeror's proposed project manager(s) and project superintendent(s)	10
8.	Subcontractors – The qualifications of the Offeror's proposed subcontractors	20
Total:		120

The Selection Committee consisting of Cypress-Fairbanks ISD administrators, architects, consultants and other staff will make an initial evaluation of the proposals. Its recommendation will be considered by the Cypress-Fairbanks ISD Board of Trustees ("Board"). The District reserves the right to review the recommendation with the Asst. Supt. of Facilities & Construction, the Director of Construction Field Services, the Director of Design and Facilities Planning, and the Director of Project Management and others deemed appropriate by the District prior to review by the entire 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.

**20. AWARD OF CONTRACT**

- A. The Owner's Selection Committee's recommendation based on an evaluation and ranking of each proposal submitted in relation to the selection criteria will be presented to the Board of Trustees for approval and award of the contract for construction. Presentation of the Selection Committee's recommendation is anticipated to occur during the Board of Trustees' meeting on **March 3, 2025**.
- B. The Owner or the Architect, on behalf of the Owner, will issue a written Notice to Proceed after award of the contract for construction by the Board of Trustees.
- C. The selected Offeror shall submit to the Owner, for review and acceptance, a Performance Bond, a Payment Bond and Certificates of Insurance within ten (10) calendar days after receipt of a written Notice to Proceed.
- D. All Offerors shall hold pricing of all alternates open for consideration and acceptance by the District/Owner as noted on Alternates proposal form.

**21. ON SITE MOBILIZATION**

- A. The selected Offeror shall not commence on-site work under this Contract until he receives a written confirmation from the Owner approving the Performance Bond, Payment Bond and Certificates of Insurance. Timely submittal of correct Bonds and Certificate of Insurance is solely the responsibility of Offeror. Additional review time by the Owner due to Contractor's failure to do so will not constitute grounds for delay claims.

**22. CONTRACT TIME AND LIQUIDATED DAMAGES**

- A. Refer to the AIA Document A201<sup>TM</sup>-2017, as Amended for Contract Time and Liquidated Damages provisions of the Contract.

**23. AVAILABILITY OF MATERIALS AND SYSTEMS**

- A. A serious effort has been made to select only materials that are asbestos free and 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 or if they contain asbestos, 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 asbestos free are included in the proposals.
- B. Decisions regarding allowance items will endeavor to be made in a timely manner to avoid construction delays.



**EXHIBIT A**

**REFERENCE LISTING FOR Cy-Fair ISD**

**2024 Cy Creek HS Renovation**

OFFEROR NAME: \_\_\_\_\_

***PROJECT No. 1***

Project Name:	_____	Completion Date:	_____
Contract Amount:	\$ _____	Square Footage:	_____
<b><i>OWNER</i></b>		<b><i>ARCHITECT</i></b>	
Contact Name:	_____	Contact Name:	_____
Phone Number:	_____	Phone Number:	_____
or Email:	_____	or Email:	_____

***PROJECT No. 2***

Project Name:	_____	Completion Date:	_____
Contract Amount:	\$ _____	Square Footage:	_____
<b><i>OWNER</i></b>		<b><i>ARCHITECT</i></b>	
Contact Name:	_____	Contact Name:	_____
Phone Number:	_____	Phone Number:	_____
or Email:	_____	or Email:	_____

***PROJECT No. 3***

Project Name:	_____	Completion Date:	_____
Contract Amount:	\$ _____	Square Footage:	_____
<b><i>OWNER</i></b>		<b><i>ARCHITECT</i></b>	
Contact Name:	_____	Contact Name:	_____
Phone Number:	_____	Phone Number:	_____
or Email:	_____	Or Email:	_____

**END OF SECTION**



**FORM AC**  
**COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL**

**2024 CY CREEK HS RENOVATION**  
**Cypress-Fairbanks Independent School District**  
**Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5754-R-RFP**  
Attn: Mr. Jesse Clayburn, Asst. Superintendent of Facilities & Construction

Submitted by: \_\_\_\_\_

Date: \_\_\_\_\_ Phone No.: \_\_\_\_\_

To: Board of Trustees  
Cypress-Fairbanks Independent School District  
Facilities and Construction  
11430-B Perry Road  
Houston, Texas 77064

Having examined Proposal and Contract Documents prepared by **VLK Architects** dated **January 20, 2025**, 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 Base Proposal open for acceptance sixty (60) days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal 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 proposal.

**I. BASE PROPOSAL**

A. 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 allowances specified in Section 01 21 00 are included in the Base Proposal and agrees that unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

**III. CONTRACT TIME**

By submittal of this proposal, the undersigned stipulates that the Base Proposal includes all costs necessary to attain Substantial Completion of the Work on or before the date stipulated in AIA Document A101™-2017.

**THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 2:00 PM, February 13, 2025**  
**COMPETITIVE SEALED PROPOSAL FORM - BASE PROPOSAL**

**IV. ADDENDA**

Undersigned acknowledges receipt of Addenda Nos. \_\_\_\_\_ dated  
\_\_\_\_\_, \_\_\_\_\_.

**V. CHANGES IN THE WORK**

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

**VI. LIQUIDATED DAMAGES**

By submittal of this proposal, the undersigned stipulates an agreement that if Substantial Completion of the Work is not attained on or before the date stipulated in AIA Document A101™-2017, the undersigned and his Surety shall be liable for and shall pay the Owner the sums stipulated as Liquidated Damages as defined in AIA Document A201™-2017.

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

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

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Contracting Firm

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Date

**FORM AC**  
**COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSALS**

**2024 CY CREEK HS RENOVATION**  
**Cypress-Fairbanks Independent School District**  
**Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5754-R-RFP**  
Attn: Mr. Jesse Clayburn, Asst. Superintendent of Facilities & Construction

Submitted by: \_\_\_\_\_

Date: \_\_\_\_\_ Phone No.: \_\_\_\_\_

To: Board of Trustees  
Cypress-Fairbanks Independent School District  
Facilities and Construction  
11430-B Perry Road  
Houston, Texas 77064

Having examined Proposal and Contract Documents prepared by **VLK Architects** dated **January 20, 2025**, 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 Alternate Proposal open for acceptance one hundred twenty (120) days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal 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 proposal.

**I. ALTERNATES**

If the Owner accepts any or all of the Alternates, the undersigned agrees to modify the Base Proposal as stipulated below:

A. Alternate Number 1 – **Base Bid Adjustment**

ADD/DEDUCT \_\_\_\_\_ Dollars \$ \_\_\_\_\_  
(Amount written in words governs) (Amount in figures)

B. Alternate Number 2A: **Chillers by Carrier**

ADD/DEDUCT \_\_\_\_\_ Dollars \$ \_\_\_\_\_  
(Amount written in words governs) (Amount in figures)

C. Alternate Number 2B: **Chillers by Daikin**

ADD/DEDUCT \_\_\_\_\_ Dollars \$ \_\_\_\_\_  
(Amount written in words governs) (Amount in figures)

**THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, February 13, 2025**  
**COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL**

D. Alternate Number 2C: *Chillers by Trane*

ADD/DEDUCT \_\_\_\_\_ Dollars \$ \_\_\_\_\_  
(Amount written in words governs) (Amount in figures)

II. UNIT PRICES

**UNIT PRICE 1:** ELECTRICAL DUPLEX RECEPTACLE \$ \_\_\_\_\_ each

**UNIT PRICE 2:** DATA DROP \$ \_\_\_\_\_ each

**UNIT PRICE 3:** VOICE DROP \$ \_\_\_\_\_ each

**UNIT PRICE 4:** DATA CABLING TO TEACHER STATION \$ \_\_\_\_\_ each

**UNIT PRICE 5:** 4 ½" THICK CONCRETE WALK PER SQUARE FOOT \$ \_\_\_\_\_ SF

**UNIT PRICE 6:** 6" THICK CONCRETE DRIVE PER SQUARE FOOT \$ \_\_\_\_\_ SF

**UNIT PRICE 7:** 7" THICK CONCRETE DRIVE PER SQUARE FOOT \$ \_\_\_\_\_ SF

**UNIT PRICE 8:** LIFE SAFETY DEVICES (including all associated cabling and programming)

- |     |                                |          |      |
|-----|--------------------------------|----------|------|
| 1.  | Exterior Horn to Speaker       | \$ _____ | each |
| 2.  | Interior Horn to Speaker       | \$ _____ | each |
| 3.  | Interior Visual Strobe         | \$ _____ | each |
| 4.  | Interior Speaker/Visual Strobe | \$ _____ | each |
| 5.  | Smoke Detector                 | \$ _____ | each |
| 6.  | Heat Detector                  | \$ _____ | each |
| 7.  | Manual Pull Station            | \$ _____ | each |
| 8.  | Stopper 2 Pull Station Cover   | \$ _____ | each |
| 9.  | Annunciator Panel              | \$ _____ | each |
| 10. | Duct Detector                  | \$ _____ | each |
| 11. | Relay                          | \$ _____ | each |
| 12. | Supervisory                    | \$ _____ | each |
| 13. | Waterflow                      | \$ _____ | each |
| 14. | Amplifier                      | \$ _____ | each |
| 15. | Remote Power Supply            | \$ _____ | each |

**UNIT PRICE 9:** GRAPHIC SIGNS

- |    |             |            |      |
|----|-------------|------------|------|
| 1. | Sign Type A | \$ _____ / | each |
| 2. | Sign Type B | \$ _____ / | each |
| 3. | Sign Type C | \$ _____ / | each |

**THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, February 13, 2025**  
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

- |    |                                   |            |      |
|----|-----------------------------------|------------|------|
| 4. | Sign Type D                       | \$ _____ / | each |
| 5. | Max Occupancy Signage             | \$ _____ / | each |
| 6. | FDC Connection Signage            | \$ _____ / | each |
| 7. | Wayfinding Signage (2 lines text) | \$ _____ / | each |
| 8. | Wayfinding Signage (3 lines text) | \$ _____ / | each |
| 9. | Wayfinding Signage (4 lines text) | \$ _____ / | each |

**UNIT PRICE 10: PAINTING**

\$ \_\_\_\_\_ each

**UNIT PRICE 11: ASBESTOS ABATEMENT COMPONENTS**

No.	Unit Price Description	Add/ Deduct (\$/Figures) Add/Deduct	Unit of Measure
ASB-1	Price per square foot for the proper removal, transportation, and disposal of interior <b>ACBM black damp proofing mastic behind brick veneer</b> . All work to be completed in compliance with AHERA and TAPHR regulations. – Full Containment	\$ _____	Square Foot
ASB-2	Price per square foot for the proper removal, transportation, and disposal of exterior <b>ACBM black damp proofing mastic behind brick veneer</b> . All work to be completed in compliance with NESHAP regulations.	Add/Deduct \$ _____	Square Foot
ASB-3	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM pipe insulation with mastic coating and/or mudded fittings</b> via glovebag removal method including all necessary regulated work area preparation and PPE	Add/Deduct \$ _____	Linear Foot
ASB-4	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM pipe insulation with mastic coating and/or mudded fittings</b> . All work to be completed in compliance with AHERA and TAPHR regulations. – Full Containment	Add/Deduct \$ _____	Linear Foot
ASB-5	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM tan/cream mastic on duct insulation</b> . All work to be completed in compliance with AHERA and TAPHR regulations. (Full Containment)	Add/Deduct \$ _____	Linear Foot
ASB-6	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM tan/cream mastic on duct insulation</b> via glovebag removal method including all necessary regulated work area preparation and PPE	Add/Deduct \$ _____	Linear Foot
ASB-7	Price per unit for the proper removal, transportation, and disposal of <b>ACBM "Transite" science tables or fire doors</b> . All work to be completed in compliance with AHERA and TAPHR regulations. (Component Removal)	Add/Deduct \$ _____	Unit
ASB-8	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM underground "Transite" fiber cement pipe</b> via glovebag removal method including all necessary regulated work area preparation and PPE	Add/Deduct \$ _____	Linear Foot

**THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, February 13, 2025**

COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

ASB-9	Price per linear foot for the proper removal, transportation, and disposal of exterior <b>ACBM underground "Transite" fiber cement pipe</b> . All work to be completed in compliance with NESHAP regulations.	Add/Deduct	Linear Foot
		\$ _____	

**UNIT PRICE 12:** EXIT SIGN \$ \_\_\_\_\_ each

**UNIT PRICE 13:** ORNAMENTAL FENCE CARRIERS & WALL REPAIRS

- |    |                                            |            |                  |
|----|--------------------------------------------|------------|------------------|
| 1. | Credit for Carrier to remain in place      | \$ _____ / | Carrier          |
| 2. | Wall Repair for Carrier to remain in place | \$ _____ / | Carrier location |

**UNIT PRICE 14:** CEILING GRID (GRID ONLY RE: DRAWINGS AND SPECS FOR CEILING TILE) \$ \_\_\_\_\_ SF

**UNIT PRICE 15:** TOILET FIXTURE AND CARRIER REPLACEMENT

- |    |                  |          |      |
|----|------------------|----------|------|
| 1. | SINK & CARRIER   | \$ _____ | each |
| 2. | TOILET & CARRIER | \$ _____ | each |
| 3. | URINAL & CARRIER | \$ _____ | each |

**III. CONTRACTOR'S PROJECT TEAM MEMBERS**

The undersigned proposes the following project team members (include resumes):

Project Manager \_\_\_\_\_

Superintendent \_\_\_\_\_

Asst. Superintendent(s) \_\_\_\_\_

Project Engineer \_\_\_\_\_



### III. PROPOSED SUBCONTRACTORS

The undersigned proposes the following subcontractors. Note – Not all trades listed below will apply to every project.

Paving: \_\_\_\_\_

Abatement: \_\_\_\_\_

Dampproofing/insulator: \_\_\_\_\_

Masonry: \_\_\_\_\_

Roofing: \_\_\_\_\_

Drywall: \_\_\_\_\_

Casework: \_\_\_\_\_

Concrete: \_\_\_\_\_

Plumbing: \_\_\_\_\_

Mechanical: \_\_\_\_\_

Electrical: \_\_\_\_\_

Fire Alarm: \_\_\_\_\_

Sprinkler: \_\_\_\_\_

Low Voltage/Security: \_\_\_\_\_

Site Utilities: \_\_\_\_\_

Earthwork/Site Prep: \_\_\_\_\_

Fencing: \_\_\_\_\_

Pre-Engineered Metal Building: \_\_\_\_\_

Glazing: \_\_\_\_\_

**THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, February 13, 2025**  
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

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

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

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Contracting Firm

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Date

**END OF FORM**

**THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, February 13, 2025**  
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSAL

**FORM AD**

**PROPOSAL BOND**

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

**THE CONDITION OF THIS OBLIGATION IS SUCH**, that whereas the Principal has submitted the accompanying  
Proposal, dated \_\_\_\_\_, \_\_\_\_\_, being for the \_\_\_\_\_, Cypress-Fairbanks  
I.S.D. Proposal Number: 24-02-5754-R-RFP for the Cypress-Fairbanks Independent School District, 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 60 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 \_\_\_\_\_, \_\_\_\_\_, 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: Signature and Printed Name

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Individual Principal: Signature and Printed Name

ATTEST:

\_\_\_\_\_  
Secretary President

BY: \_\_\_\_\_

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Corporate Surety

ATTEST: \_\_\_\_\_

BY: \_\_\_\_\_

**END OF FORM**

***NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH ALTERNATE PROPOSAL.***



**FORM AE**

**FELONY CONVICTION NOTIFICATION**

**Note: The Statement of Affirmation Must Be Notarized**

**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 proposal, 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 Printed

Name \_\_\_\_\_ Position/Title \_\_\_\_\_

Offeror's

Signature \_\_\_\_\_ Date \_\_\_\_\_

Subscribed and sworn to me on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Notary Public

My Commission expires \_\_\_\_\_

***NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL***

**END OF FORM**









**FORM AG**

**PROPOSAL EVALUATION WAIVER**

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

**NOTE:** The Statement of Affirmation Must Be Notarized.

**STATEMENT OF AFFIRMATION**

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

Firm's Name \_\_\_\_\_ Address: \_\_\_\_\_

Proposer's Printed  
Name \_\_\_\_\_ Position/Title \_\_\_\_\_

Proposer's  
Signature \_\_\_\_\_ Date \_\_\_\_\_

Subscribed and sworn to me on this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

My Commission expires \_\_\_\_\_

***NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL.***

**END OF FORM**



**FORM AH**

**AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT**

STATE OF TEXAS                    )  
                                                  )  
COUNTY OF HARRIS                )

**AFFIDAVIT**

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

SIGNED: \_\_\_\_\_

DATE: \_\_\_\_\_

PRINTED NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

COMPANY: \_\_\_\_\_

The person signing above hereby certifies that he or she is fully authorized and empowered to execute this instrument and to bind the person or entity named hereto and does in fact so execute this instrument.

STATE OF TEXAS

COUNTY OF \_\_\_\_\_)

Subscribed and sworn before me on this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

My Commission expires \_\_\_\_\_

***NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH BASE PROPOSAL***

**END OF FORM**



**FORM AI**

**FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENT**

\*\*\*\*\*

**CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT**

Cypress-Fairbanks Independent School District

2024 Cy Creek HS Renovation

Cypress-Fairbanks ISD Proposal Number: 24-02-5754-R-RFP

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 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 lay 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 **Cypress-Fairbanks Independent School District** (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 paying full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date \_\_\_\_\_

\_\_\_\_\_ (Company name)

By \_\_\_\_\_ (Signature)

\_\_\_\_\_ (Printed/Typed name)

\_\_\_\_\_ (Title)

SWORN AND SUBSCRIBED before me at \_\_\_\_\_, this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_ Notary Public in and for the state of \_\_\_\_\_.

**FORM AI**

**FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENT**

\*\*\*\*\*

**UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT**

Cypress-Fairbanks Independent School District

2024 Cy Creek HS Renovation

Cypress-Fairbanks ISD Proposal Number: 24-02-5754-R-RFP

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

**UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT**

The signer of this document has been paid and has received a progress payment in the sum of \$ \_\_\_\_\_  
for all labor, services, equipment, or materials furnished to the property or to \_\_\_\_\_  
(person with whom signer contracted) on the property of Cypress-Fairbanks Independent School District (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 statements(s) or progress payment request(s).

Date \_\_\_\_\_

\_\_\_\_\_ (Company name)

By \_\_\_\_\_ (Signature)

\_\_\_\_\_ (Printed/Typed name)

\_\_\_\_\_ (Title)

SWORN AND SUBSCRIBED before me at \_\_\_\_\_, this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_ Notary Public in and for the state of \_\_\_\_\_.

**FORM AI**

**FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENT**

\*\*\*\*\*

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Cypress-Fairbanks Independent School District

2024 Cy Creek HS Renovation

Cypress-Fairbanks ISD Proposal Number: 24-02-5754-R-RFP

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 **Cypress-Fairbanks Independent School District** (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), inclusive of all modifications and changes therein.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date \_\_\_\_\_

\_\_\_\_\_ (Company name)

By \_\_\_\_\_ (Signature)

\_\_\_\_\_ (Printed/Typed name)

\_\_\_\_\_ (Title)

SWORN AND SUBSCRIBED before me at \_\_\_\_\_, this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_ Notary Public in and for the state of \_\_\_\_\_.

**FORM AI**

**FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENT**

\*\*\*\*\*

**UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT**

Cypress-Fairbanks Independent School District

2024 Cy Creek HS Renovation

Cypress-Fairbanks ISD Proposal Number: 24-02-5754-R-RFP

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**

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 **Cypress-Fairbanks Independent School District** (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)

\_\_\_\_\_ (Printed/Typed name)

\_\_\_\_\_ (Title)

SWORN AND SUBSCRIBED before me at \_\_\_\_\_, this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_ Notary Public in and for the state of \_\_\_\_\_.



**FORM AJ**

**WARRANTY CERTIFICATE**

PROJECT NAME: 2024 Cy Creek HS Renovation  
Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5754-R-RFP  
Architect's Project Number: 23-148.00  
Address: \_\_\_\_\_

**OWNER NAME:** *Cypress-Fairbanks Independent School District*

**Phone No.** *(281) 897-4108*

\_\_\_\_\_  
(Name of Company) Warrants \_\_\_\_\_  
(Description of Work/Products/ Division Number)

\_\_\_\_\_  
against defective materials, workmanship, machinery, hardware, and equipment. The above-mentioned company agrees to repair or replace such defective items at its own expense for a period of \_\_\_\_\_ year/s from the Date of Substantial Completion.

**FIRM ISSUING WARRANTY:** \_\_\_\_\_ **Phone No.** \_\_\_\_\_

**Address:** \_\_\_\_\_ **City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

\_\_\_\_\_  
IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, 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.

\_\_\_\_\_  
(Printed Name)

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Title)

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

Subscribed and sworn before me on this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

My Commission expires \_\_\_\_\_



**FORM AK**

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

Complete this form and return to the Architect upon close-out of the project.

PROJECT NAME: 2024 Cy Creek HS Renovation

Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5754-R-RFP

Architect's Project Numbers: 23-148.00

OWNER NAME: Cypress-Fairbanks Independent School District

Phone No. (281) 897-4108

Address: 11440 Matzke Rd., Cypress, Texas 77429

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 bibs, as applicable to the project. Lead sheet flashing used in through roof plumbing penetration applications is the only permissible lead-containing material on the Project.

SIGNED: \_\_\_\_\_

DATE: \_\_\_\_\_

PRINTED NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

COMPANY: \_\_\_\_\_

The person signing above hereby certifies that he or she is fully authorized and empowered to execute this instrument and to bind the person or entity named hereto and does in fact so execute this instrument.

STATE OF TEXAS

COUNTY OF \_\_\_\_\_)

Subscribed and sworn before me on this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

My Commission expires \_\_\_\_\_

**END OF FORM**



# 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:** Cypress-Fairbanks I.S.D.

**Facility:** 2024 Cy Creek HS Renovation

**ARCHITECT/ENGINEER:** VLK Architects

**Address:** 9815 Grant Rd.

**CONTRACTOR/CM:** TBD

**City:** Houston, TX 77070

**CONTRACT DATE:** TBD

**DATE DISTRICT AUTHORIZED PROJECT:** 2019 Bond authorized 5/4/19, Phase 6 authorized 11/1/23

## BRIEF DESCRIPTION OF PROJECT:

CFISD Project Number: 24-02-5754-R-RFP

Various renovations, program additions, mechanical/electrical/plumbing upgrades and security enhancements to an existing high school.

## 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:** Cypress-Fairbanks I.S.D.

**BY:** 

**DATE:** 2/29/2024

**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:** Arcadis

**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:** TBD

**BY:**

**DATE:**

**6. The District** certifies completion of the project (as defined by the architect/engineer and contractor).

**DISTRICT:** Cypress-Fairbanks I.S.D.

**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.

## REQUEST FOR CLARIFICATION DURING PROPOSAL PROCESS

PROJECT: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

SUBMITTED BY: \_\_\_\_\_

PRINTED NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

FAX: \_\_\_\_\_

EMAIL: \_\_\_\_\_

[illegible]

AM - 1





## SECTION AN

### Conflict of Interest Questionnaire

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 Cypress-Fairbanks Independent School District must file a completed Conflict of Interest Questionnaire with the Purchasing 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 proposals or bids, correspondence, or another writing related to a potential agreement with the District.

Each Proposer must complete the on-line version of the Conflict Of Interest Questionnaire at the following website:

<https://app.cfsd.net/ciq/index.aspx>

Full instructions for completing the Questionnaire are included at this website.

---

### CERTIFICATION OF PROPOSER'S COMPLETION OF CONFLICT OF INTEREST QUESTIONNAIRE

The undersigned certifies that he has completed the Conflict of Interest Questionnaire per the above information.

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

\_\_\_\_\_  
Authorized Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Name of Contracting Firm

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Date



TO BE INITIALED BY ARCHITECT AND CONTRACTOR PRIOR TO OWNER'S FINAL CLOSEOUT REVIEW

PROJECT NAME:

NOTE: SUBMIT ALL DOCUMENTS RELATED TO SUBCONTRACTORS AND SUPPLIERS IN ALPHABETICAL ORDER BY NAME OF COMPANY UNLESS NOTED OTHERWISE

	<u>Contractor's</u> <u>Initials</u>	<u>Architect's</u> <u>Initials</u>	<u>CFISD PM</u> <u>Initials</u>
CFISD Close Out Log - with Subcontractors Filled Out			
List of Project Team			
List of Final Subcontractor/Suppliers/Local Representatives (Form AF)			
"Consent of Surety to Final Payment" AIA G707			
<input type="checkbox"/> 1. Check for Corporate Seal			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
"Contractor's Affidavit of Payment of Debts and Claims" AIA G706			
<input type="checkbox"/> 1. Check for Notary			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
"Contractor's Affidavit of Release of Liens" AIA G706A			
<input type="checkbox"/> 1. Check for Notary			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
Subcontractors' Waiver of Lien (Subcontractors/Major Suppliers) (Conditional or Unconditional) (Form AI)			
<input type="checkbox"/> 1. Check against Subcontractor List			
<input type="checkbox"/> 2. Check for Notary			
<input type="checkbox"/> 3. Check for Original Signature			
<input type="checkbox"/> 4. Check for Project Name			
"Certificate of Substantial Completion" AIA G704			
Allowances			
<input type="checkbox"/> 1. CPR Execution Complete (Owner)			
<input type="checkbox"/> 2. Account Balance Review (Owner)			
<input type="checkbox"/> 3. Executed Final Change Order			
Architect letter confirming all punch list items complete (Architect)			
<input type="checkbox"/> 1. Final Signed Off Punch list			
List of All Permits during Job and a Copy of All Permits			
Storm Water Quality Permit (As-Built Certificate)			
<input type="checkbox"/> 1. Check for Original Signature			
<input type="checkbox"/> 2. Check for Project Name			
<input type="checkbox"/> 3. Check for Permit Number			
<input type="checkbox"/> 4. Check for Engineer License Seal			

**PROJECT CLOSE OUT – FORM AO**

	<u>Contractor's</u> <u>Initials</u>	<u>Architect's</u> <u>Initials</u>	<u>CFISD PM</u> <u>Initials</u>
Utilities ( <b>Owner</b> )			
<input type="checkbox"/> Invoice/Check for Electricity			
<input type="checkbox"/> Invoice/Check for Gas			
<input type="checkbox"/> Invoice/Check for Water/Sewer/Irrigation			
Contractor's Overtime			
<input type="checkbox"/> Invoices Sent to Contractor (Owner)			
<input type="checkbox"/> Payment Received by Contractor (Owner)			
Copy of Certificate of Compliance/Occupancy from local governmental Authorities			
Project Compliance Certificate ( <b>Owner Form AL</b> )			
<input type="checkbox"/> 1. Check for Original Signature			
<input type="checkbox"/> 2. Check for Project Name			
Hazardous Material Certificate (Architect, General Contractor/Contractor, Subcontractors, and Material/Equipment Suppliers) Each shall be notarized. ( <b>Form AK</b> )			
<input type="checkbox"/> 1. Check against Subcontractor List			
<input type="checkbox"/> 2. Check for Notary			
<input type="checkbox"/> 3. Check for Project Name			
<input type="checkbox"/> 4. Check for Original Signature			
Asbestos Manifest			
<input type="checkbox"/> Signed by all appropriate parties			
Report from Asbestos Consultant confirming abatement observations and air monitoring			
<input type="checkbox"/> 1. Asbestos Reports			
<input type="checkbox"/> 2. <i>Transmit Originals to Maintenance, Keep Copies for File. (Owner)</i>			
Letter from Building Envelope Consultant confirming all deficiency items complete			
Roofing Warranty & Documentation			
<input type="checkbox"/> <i>Send Copies to Director of Maintenance (Owner)</i>			
<input type="checkbox"/> Compliance letter on Roofing from Roofing Consultant			
<input type="checkbox"/> Roofing Manufacturer Letter confirming Warranty			
<input type="checkbox"/> Copy to Roof Warranty Binder (Owner)			
<input type="checkbox"/> Place Original in Roof Warranties Binder (Owner)			
TDLR Inspection			
<input type="checkbox"/> Inspection Report			
<input type="checkbox"/> Deficiencies documented and corrected (if applicable)			
<input type="checkbox"/> Approval letter from TDLR			
Letter from Test & Balance Consultant confirming all deficiency items complete			
Letter from Commissioning Consultant confirming all deficiency items complete			
Letter from Structural Engineer confirming conformance with design ( <b>provided by Architect</b> )			
Letter from Civil Engineer confirming conformance with design ( <b>provided by Architect</b> )			

PROJECT CLOSE OUT – FORM AO

	<u>Contractor's</u> <u>Initials</u>	<u>Architect's</u> <u>Initials</u>	<u>CFISD PM</u> <u>Initials</u>
Letter from Mechanical Engineer confirming conformance with design <b>(provided by Architect)</b>	_____	_____	_____
Letter from Materials Testing Consultant confirming all deficiency items complete	_____	_____	_____
Letter from Consultants confirming conformance with design if applicable <i>(Provided by Consultant, FDP, C-H, etc.)</i>	_____	_____	_____
Copy of all Gas Pipe Test Results Form	_____	_____	_____
Elevators	_____	_____	_____
<input type="checkbox"/> Maintenance Service Agreement			
<input type="checkbox"/> Send Copy to Maintenance (Owner)			
General Contractor's Written Guarantee <b>(Form AJ)</b>	_____	_____	_____
<input type="checkbox"/> 1. Check for Notary			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
Subcontractors' Written Guarantee <b>(Form AJ)</b>	_____	_____	_____
<input type="checkbox"/> 1. Check against Subcontractor List			
<input type="checkbox"/> 2. Check for Original Signature			
<input type="checkbox"/> 3. Check for Project Name			
<input type="checkbox"/> 4. Check for Notary			
<input type="checkbox"/> 5. State date to be date of Substantial Completion of final phase of project			
Extended Warranties & Maintenance List	_____	_____	_____
Insurance Certificate documenting continuing coverage after Final Payment <b>(see AIA Document A201™–2017, as amended, Article 11.1.3)</b>	_____	_____	_____
Workers' Compensation Certificates	_____	_____	_____
<input type="checkbox"/> General Contractor			
<input type="checkbox"/> <u>ALL</u> Subcontractors			
All Extra Stock Transmittals by Division	_____	_____	_____
<input type="checkbox"/> Divisions 0 – 21			
<input type="checkbox"/> Division 22 Plumbing			
<input type="checkbox"/> Division 23 HVAC			
<input type="checkbox"/> Division 26 Electrical			
<input type="checkbox"/> Division 27, 28 and beyond as applicable			
CFISD Master Keys Returned	_____	_____	_____
Paint Mix Cards	_____	_____	_____
List of Finishes used in Project	_____	_____	_____
Demonstration and Training Sign In Sheets by Division with Digital Video if applicable	_____	_____	_____

PROJECT CLOSE OUT – FORM AO

	<u>Contractor's</u> <u>Initials</u>	<u>Architect's</u> <u>Initials</u>	<u>CFISD PM</u> <u>Initials</u>
Maintenance/Operations Manuals (2 hard copies, 1 digital copy) (Reviewed/Approved by Architect)	_____	_____	_____
<input type="checkbox"/> Divisions 0 – 21			
<input type="checkbox"/> Division 22 Plumbing			
<input type="checkbox"/> Division 23 HVAC			
<input type="checkbox"/> Division 26 Electrical			
<input type="checkbox"/> Division 27, 28 and beyond as applicable			
Record Drawings / As-Builts	_____	_____	_____
<input type="checkbox"/> 1. Record CAD Files			
<input type="checkbox"/> 2. Record PDF Files			

The undersigned Contractor certifies that to the best of the Contractor’s knowledge, information and belief the close out documentation attached has been accurately completed in accordance with the Contract Documents, and requests permission to submit the FINAL Application and Certification for Payment AIA G702 Document for the outstanding retainage owed under the contract.

**Contractor:**  
By: \_\_\_\_\_

Print Name: \_\_\_\_\_

In accordance with the Contract Documents, based on data comprising the attached, the Architect certifies to the Owner that to the best of the Architect’s knowledge, information and belief the Project Close Out Documents have been completed as indicated, the accuracy of the documents is in accordance with the Contract Documents.

**Architect:**  
By: \_\_\_\_\_

Print Name: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

CFISD Project Manager Signature: _____	Date: _____
CFISD Director of Project Management Signature: _____	Date: _____
CFISD Director of Contract Management Signature: _____	Date: _____
CFISD Assistant Superintendent Signature: _____	Date: _____

---

## FORM AP – Contractor

### SB 9 Public Works Contractor Certification

**Introduction:** Texas Education Code Chapter 22 requires entities that contract with school district contractors to obtain criminal history record information regarding covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors must certify to the District that they have complied.

The District may not obtain criminal histories for contractors: The law requires each contractor to obtain the criminal histories of its covered employees.

**Definitions:**

**Covered employees:** Employees of a contractor who have or will have continuing duties related to the service to be performed at the District and have or will have the opportunity for direct contact with students in connection with the person's continuing duties. The District will be the final arbiter of what constitutes *continuing duties* or *direct contact* with students. **Disqualifying criminal history:** (1) a conviction or other criminal history information designated by the District or (2) a conviction for one of the following offenses during the preceding 30 years, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; (c) an equivalent offense under federal law or the laws of another state. Title 5 felony offenses include criminal homicide; kidnapping, unlawful restraint, and smuggling of persons; trafficking of persons; sexual offenses; and assaultive offenses.

---

On behalf of \_\_\_\_\_ ("Contractor"), I, the undersigned authorized signatory for Contractor, certify to Cypress-Fairbanks Independent School District ("District") and Contractor that [check one]:

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

Or

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

- 1) Contractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.
- 2) If Contractor receives information that a covered employee subsequently has a reported criminal history, Contractor will immediately remove the covered employee from contract duties and notify the District in writing with 3 business days.
- 3) Upon request, Contractor will provide the District with the name and any other requested information of covered employees so that the District may obtain criminal history record information on the covered employees.

All company employees must have a CFISD badge prior to working on district property.

There is a processing fee of \$7 per badge requested, for which an invoice will be submitted. This fee is a processing fee per individual submitted on the Employee List Form and is charged regardless of whether the individual is approved to receive a badge.

If the District objects to the assignment of a covered employee based on the covered employee's criminal history record information, Contractor agrees to discontinue using that covered employee to provide services at the District.

I also certify to the District on behalf of Contractor that Contractor has obtained certifications from its subcontractors of compliance with Education Code, Chapter 22.

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

---

Signature

Date

---

Title

Submit completed form to: Cypress-Fairbanks ISD, Facilities & Construction Office: [contractor\\_badges@cfisd.net](mailto:contractor_badges@cfisd.net)

---

**Notes**

Public works contractor employees must have opportunity for *direct contact with students* in order to be subject to a mandatory criminal history review. Tex. Educ. Code § .08341(b)(2). Direct contact with students is contact that results from activities that provide substantial opportunity for verbal or physical interaction with students and that is not supervised by a certified educator or other professional district employee.

For public works contractor employees, a person does not have the opportunity for direct contact with students if:

- the public work does not involve the construction, alteration, or repair of an instructional facility;
- if the public work involves construction of a *new* instructional facility, the person's duties related to the contracted services will be completed not later than the seventh day before the first date the facility will be used for instructional purposes; *or*
- if the public work involves an existing instructional facility:
  - the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; *and*
  - the contractor adopts a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area.

"Instructional facility" means real property, an improvement to real property, or a necessary fixture of an improvement to real property that is used predominantly for teaching the curriculum required under Texas Education Code section 28.002.



## FORM AP - Subcontractor SB 9 Public Works Contractor Certification

**Introduction:** Texas Education Code Chapter 22 requires entities that contract with school district contractors to obtain criminal history record information regarding covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Subcontractors must certify to the District and to the contractor that they have complied.

The District may not obtain criminal histories for subcontractors: The law requires each subcontractor to obtain the criminal histories of its covered employees.

### Definitions:

**Covered employees:** Employees of a subcontractor who have or will have continuing duties related to the service to be performed at the District and have or will have the opportunity for direct contact with students in connection with the person's continuing duties. The District will be the final arbiter of what constitutes *continuing duties* or *direct contact* with students. **Disqualifying criminal history:** (1) a conviction or other criminal history information designated by the District or (2) a conviction for one of the following offenses during the preceding 30 years, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; (c) an equivalent offense under federal law or the laws of another state. Title 5 felony offenses include criminal homicide; kidnapping, unlawful restraint, and smuggling of persons; trafficking of persons; sexual offenses; and assaultive offenses.

Subcontractor has entered a contract with \_\_\_\_\_ ("Contractor") to provide services in connection with contract between Cypress-Fairbanks Independent School District ("District") and Contractor. On behalf of \_\_\_\_\_ ("Subcontractor"), I, the undersigned authorized signatory for Subcontractor, certify to the District and Contractor that [check one]:

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

Or

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

- 1) Subcontractor has obtained all required criminal history record information regarding its covered employees. None of the covered employees has a disqualifying criminal history.
- 2) If Subcontractor receives information that a covered employee subsequently has a reported criminal history, Subcontractor will immediately remove the covered employee from contract duties and notify the District in writing with 3 business days.
- 3) Upon request, Subcontractor will provide the District with the name and any other requested information of covered employees so that the District may obtain criminal history record information on the covered employees.

All company employees must have a CFISD badge prior to working on district property.

There is a processing fee of \$7 per badge requested, for which an invoice will be submitted. This fee is a processing fee per individual submitted on the Employee List Form and is charged regardless of whether the individual is approved to receive a badge.

If the District objects to the assignment of a covered employee based on the covered employee's criminal history record information, Subcontractor agrees to discontinue using that covered employee to provide services at the District.

I also certify to the District and Contractor on behalf of Subcontractor that Subcontractor has obtained certifications from its subcontractors of compliance with Education Code, Chapter 22.

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

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Title

Submit completed form to: Cypress-Fairbanks ISD, Facilities & Construction Office: [contractor\\_badges@cfisd.net](mailto:contractor_badges@cfisd.net)

---

**Notes**

Public work subcontractor employees must have opportunity for *direct contact with students* in order to be subject to a mandatory criminal history review. Tex. Educ. Code § .08341(b)(2). Direct contact with students is contact that results from activities that provide substantial opportunity for verbal or physical interaction with students and that is not supervised by a certified educator or other professional district employee.

For public works subcontractor employees, a person does not have the opportunity for direct contact with students if:

- the public work does not involve the construction, alteration, or repair of an instructional facility;
- if the public work involves construction of a *new* instructional facility, the person's duties related to the contracted services will be completed not later than the seventh day before the first date the facility will be used for instructional purposes; *or*
- if the public work involves an existing instructional facility:
  - the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; *and*
  - the contractor adopts a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area.

"Instructional facility" means real property, an improvement to real property, or a necessary fixture of an improvement to real property that is used predominantly for teaching the curriculum required under Texas Education Code section 28.002.





FACILITIES PLANNING AND CONSTRUCTION

**CERTIFICATE OF FINAL COMPLETION (AQ)**

Project Name:	2024 Cy Creek HS Renovation	Project No.:	24-02-5754-R-RFP
Contractor:			
Contract No.:	23-148.00	Contract Date:	
Architect/Engineer:	VLK Architects		
Date of Final Completion:		Time of Final Completion (include Time Zone CT):	

**DATE OF FINAL COMPLETION**

The work performed under this contract has been inspected and found to be complete. This constitutes the Owner's acceptance for final completion for the **ENTIRE** contract amount. The date of final completion of the project is hereby established as set forth above.

In accordance with the General Conditions and Supplementary Conditions of the contract, this is to confirm the results of the final completion inspection(s). The Contractor has completed the list of items identified on the pre-final and final punch list(s) that the inspection team required corrected or completed before final acceptance of the work in accordance with the contract. Work accepted with incomplete punch list items or failure of the Owner or other parties to identify work that does not comply with the contract documents or is defective in operation or workmanship does not constitute a waiver of the Owner's rights under the contract or relieve the Contractor of its responsibility for performance or warranties.

In accordance with the contract, the date of final completion is that date jointly certified by the Contractor, Architect/Engineer and Owner that the work is completed and the contract is fully satisfied according the contract documents. Completion of all work is a condition precedent to the Contractor's right to receive final payment.

The **CONTRACTOR** has completed/corrected the items identified on all referenced punch list(s) and the requirements of the contract are fully satisfied according to the contract documents.

_____	_____	_____
<i>Project Manager</i>	<i>(Print Name)</i>	<i>(Date)</i>

The **ARCHITECT** agrees that the work noted in this Certificate of Final Completion is completed in accordance with the contract documents.

_____	_____	_____
<i>Project Architect</i>	<i>(Print Name)</i>	<i>(Date)</i>

The **OWNER** accepts the work designated herein to be in accordance with the requirements for final completion, except as provided in the contract documents.

_____	_____	_____
<i>Project Manager</i>	<i>(Print Name)</i>	<i>(Date)</i>

_____	_____	_____
<i>Director of Construction Field Services</i>	<i>(Print Name)</i>	<i>(Date)</i>

_____	_____	_____
<i>Director of Project Management</i>	<i>(Print Name)</i>	<i>(Date)</i>

_____	_____	_____
<i>Director of Contract Management</i>	<i>(Print Name)</i>	<i>(Date)</i>

_____	_____	_____
<i>Assistant Supt. of Facilities &amp; Construction</i>	<i>(Print Name)</i>	<i>(Date)</i>

_____	_____	_____
<i>Chief Operations Officer</i>	<i>(Print Name)</i>	<i>(Date)</i>
<i>Associate Supt. of Facilities, Construction &amp; Support Services</i>		



## SECTION AR

### DISCLOSURE OF INTERESTED PARTIES

Section 2252.908 of the Texas Government Code requires a business entity that enters into a contract with a school district must submit a disclosure of interested parties (Form 1295) to the school district and state agency and applies to contracts with a value of \$1,000,000.00 or greater and applies to all contracts entered into on or after January 01, 2016.

An example of the Form 1295 is included in this section; however the form shall be required to be filled out online, printed and signed, and submitted with the contract of which it is applicable.

#### Filing Process:

By January 01, 2016, the Texas Ethics Commission will make available on its website a new filing application that must be used to file Form 1295. A business entity must use the application to enter the required information on Form 1295 and print a copy of the form and a separate certification of filing that will contain a unique certification number. An authorized agent of the business entity must sign the printed copy of the form and have the form notarized. The completed Form 1295 and certification of filing must be filed with the governmental body or state agency with which the business entity is entering into the contract.

The governmental entity or state agency must notify the commission, using the commission's filing application, of the receipt of the filed Form 1295 and certification of filing not later than the 30<sup>th</sup> day after the date the contract binds all parties to the contract. The commission will post the completed Form 1295 to its website within seven business days after receiving notice from the governmental entity or state agency.

Information regarding how to use the filing application will be available on the Texas Ethics Commissions site by January 01, 2016 at [www.ethics.state.tx.us](http://www.ethics.state.tx.us).

<b>CERTIFICATE OF INTERESTED PARTIES</b>			<b>FORM 1295</b>																	
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.			<b>OFFICE USE ONLY</b>  <div style="font-size: 2em; transform: rotate(-30deg); opacity: 0.5;">Must file online at <a href="http://www.ethics.state.tx.us/File">www.ethics.state.tx.us/File</a></div>																	
<b>1</b> Name of business entity filing form, and the city, state and country of the business entity's place of business.																				
<b>2</b> Name of governmental entity or state agency that is a party to the contract for which the form is being filed.																				
<b>3</b> Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.																				
<b>4</b> Name of Interested Party		City, State, Country (place of business)		Nature of Interest (check applicable) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; padding: 5px;">Controlling</th> <th style="width: 50%; padding: 5px;">Intermediary</th> </tr> </thead> <tbody> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td></tr> </tbody> </table>	Controlling	Intermediary														
Controlling	Intermediary																			
<b>5</b> Check only if there is NO Interested Party. <span style="float: right;"><input type="checkbox"/></span>																				
<b>6 UNSWORN DECLARATION</b> My name is _____, and my date of birth is _____. My address _____ (street) _____ (city) _____ (state) _____ (zip code) _____ (country). I declare under penalty of perjury that the foregoing is true and correct. Executed in _____ County, State of _____, on the _____ day of _____, 20_____. <span style="float: right;">(month) (year)</span> <div style="text-align: right; margin-top: 20px;">             _____              Signature of authorized agent of contracting business entity              (Declarant)           </div>																				
<b>ADD ADDITIONAL PAGES AS NECESSARY</b>																				



**DOCUMENT BA**

**CONTRACT DOCUMENTS**

**I. CONSTRUCTION CONTRACT AGREEMENT**

- A. The contract for the construction of the project shall be executed by the successful Offeror on the AIA Document A101™-2017, as amended "Standard Form of Agreement between Owner and Contractor." A Notice to Proceed shall be issued 10 days following Board Award.
- B. A sample of this AIA Document A101™-2017, as amended is attached here within.

**II. CONDITIONS OF THE CONTRACT**

- A. General Conditions:
  - 1. The General Conditions of the Contract for Construction AIA Document A201™-2017, as supplemented and amended herein, constitutes the General Conditions and is hereby specifically made part of the Contract Documents.
- B. Supplementary Conditions:
  - 1. For modifications to the General Conditions of the Contract for Construction AIA Document A201™-2017, as amended refer to Section CB for the Supplementary Conditions.

**END OF DOCUMENT**



# FOR REFERENCE ONLY

## DRAFT 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]TH day of [MONTH] in the year 2025  
(In words, indicate day, month and year.)

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

Cypress-Fairbanks Independent School District  
11430-B Perry Road  
Houston, Texas 77064  
Telephone: 281-897-4057  
Fax: 281-897-3806

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

« (TBD) »  
« »  
« Telephone: »

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

**PROJECT NAME**  
CFISD Project Number: XX-XX-XXXXR-RFP  
Architect Project No. XXXX

**ADDRESS**

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

**ARCHITECT INFO**

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.

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.

**ELECTRONIC COPYING** of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

## TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	THE WORK OF THIS CONTRACT
3	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
4	CONTRACT SUM
5	PAYMENTS
6	DISPUTE RESOLUTION
7	TERMINATION OR SUSPENSION
8	MISCELLANEOUS PROVISIONS
9	ENUMERATION OF CONTRACT DOCUMENTS
10	INSURANCE AND BONDS

### ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), all sections of the Project Manual and Construction Documents, Drawings, Specifications, Addenda issued prior to execution of this Agreement, the Contractor's proposal and written amendments or addenda to the proposal, the Contractor's bonds and proof of insurance, other documents listed in this Agreement, Modifications issued after execution of this Agreement, and attached exhibits; these 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.

"Construction Documents" means: all drawings, specifications, submittals, transmittals, deliverables, instructions to Contractors, and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants and which set forth in detail the requirements for construction of the Project.

### 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.

☒ [ « X » ] A date set forth in a notice to proceed issued by the Owner. The Contractor may not commence construction, however, until all bonds and insurance required by the Contract Documents have been received by the Owner. All bonds and insurance will be reviewed and approved by the Owner for compliance with the Contract Documents prior to the Contractor mobilizing onsite. Upon Owner approval, the Contractor will be allowed to mobilize onsite.

☐ [ « » ] 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.

# FOR REFERENCE ONLY

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

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than the date(s) listed below:

*(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)*

Portion of Work	Substantial Completion Date
Entire Scope of Work	[REFER TO SUMMARY OF WORK]

subject to adjustments of the Contract Time as provided in the Contract Documents.

(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

Contractor shall achieve buy out of all subcontracts and trades within thirty (30) days following Notice to Proceed.

Contractor shall provide complete Schedule of Values within thirty (30) days following Notice to Proceed.

Liquidated Damages: Refer to AIA Document A201™–2017, General Conditions of the Contract for Construction as amended, Article 8.4.

## 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 XXXX Dollars (\$0.00), subject to additions and deductions as provided in the Contract Documents.

§ 4.1.1 The Contract Sum contains an Owner's Betterment Allowance in the amount of XXXX Dollars (\$0.00). This allowance is for the sole use of the Owner to be used for changes in the scope of the Work and for the betterment of the Project. Owner's authorized representative may approve any expenditure from Owner's Betterment Allowance without further Board of Trustees approval. If the Owner's Betterment Allowance is not expended or not fully expended, then any unused portion shall belong to the Owner and shall be credited to the Owner in calculating final payment.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

*(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)*

Base Proposal in the amount of .....\$0.00

Total Contract Sum.....\$0.00

Refer to Exhibit A (includes Base Proposal, Alternate Proposal(s) and Unit Price(s).)

§ 4.3 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)
------	-----------------------	-------------------------

Refer to Exhibit A, Form AC – Competitive Sealed Proposal Form, Base Proposal and Alternate Proposal

§ 4.4 Allowances included in the Contract Sum, if any:

# FOR REFERENCE ONLY

(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Allowance Amount
Owner's Betterment Allowance	[REFER TO ALLOWANCE]

## 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 at equal one-month intervals. No more than one (1) Application for Payment may be submitted within a given calendar month and shall be submitted to the Owner as required in AIA Document A201™-2017, as amended Article 9.3.6.

§ 5.1.3 The Owner shall make payment of the undisputed, certified amount to the Contractor not later than thirty (30) days after Owner received the Application for Payment, that has been certified by the Architect. If errors are discovered by the Owner in the certified Application for Payment, the Owner shall reject the Application for Payment and return it to the Contractor for correction. The specified time period for payment of such Application for Payment will start over on the date the Owner receives the corrected Application for Payment that has been re-certified by the Architect.

§ 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, unless objected to by the Architect and Owner, 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 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of five percent (5.0%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.8 of AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended;
- .2 Add 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), less retainage of five percent (5.0%);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201™-2017, as amended.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201™-2017, as amended.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

# FOR REFERENCE ONLY

*(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)*

«The full applicable five percent (5.0%) retainage will be held until Final Completion of the Work associated with the Contract has been achieved. »

§ 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 Section 12.2 of AIA Document A201–2017, as amended, 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.
- .3 all project close-out documents in their entirety have been completed, submitted to and approved by the Owner.

§ 5.2.2 Upon verification and approval by the Architect and Owner that all Contract requirements have been completed in their entirety, the Contractor shall submit the final Application for Payment to the Architect for approval and certification. Upon receipt of such final Certificate for Payment, the Owner's final payment to the Contractor shall be made no later than thirty (30) days after the issuance of the Architect's final Certificate for Payment, or as follows:

If the Contractor submits the Final Application for Payment to the Architect prior to the verification and approval by the Architect and Owner that the Contractor has completed all Contract requirements, the Architect will return the Application for Final Payment to the Contractor as NOT APPROVED. If errors are discovered by the Owner in the certified Final Application for Payment, the Owner shall reject the Final Application for Payment and return it to the Contractor for correction. The specified time period for payment of such final Application for Payment will start over on the date the Owner receives the corrected final Application for Payment that has been certified by the Architect. Refer to AIA Document A201™–2017, Article 9 as amended.

§ 5.2.3 At the end of the project, after all work is completed according to the Contract Documents, including all closeout documents, the Owner shall release all retainage to the subcontractors, sub-subcontractors and vendors. The retainage for the General Contractor, including, but not limited to, all work self-performed by the General Contractor; and all general condition line items, shall be held until all lien releases have been provided to and accepted by the Owner.

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.

## § 5.3 Interest

Payments due and unpaid under the Contract for undisputed amounts shall bear interest pursuant to Texas Prompt Payment Act.

## ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Refer to AIA Document A201–2017, Article 4 as amended. For any Claim or dispute not resolved by the process in Article 4 of AIA Document A201-2017, as amended, the method of binding dispute resolution shall be 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, as amended.

# FOR REFERENCE ONLY

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

## ARTICLE 8 MISCELLANEOUS PROVISIONS

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

§ 8.2 The Agreement shall be governed by the laws of the State of Texas, and any litigation shall be conducted in state district court. Mandatory and exclusive venue shall be in Harris County, Texas.

§ 8.3 As a material consideration of the making of this Agreement, the modifications to this Agreement shall not be construed against the maker of said modifications.

§ 8.4 Notwithstanding anything to the contrary in this Agreement, or in any document forming a part hereof, there shall be no mandatory arbitration for any dispute arising hereunder.

§ 8.5 The Contractor may not assign its responsibilities, duties, obligations, and rights under this Agreement, without the express written consent of the Owner. This does not prevent Contractor from engaging subcontractors to perform various phases of the Project, but Contractor shall be fully responsible to Owner for the Work, actions, and omissions of all such subcontractors.

§ 8.6 This Agreement, in its entirety, shall be binding upon all the parties hereto, their respective successor, heirs, executors, administrators, or assigns.

§ 8.7 Execution of this Agreement shall constitute approval and acceptance of all terms, covenants, and conditions as modified and contained in the Contract Documents.

§ 8.8 This Agreement is subject to all applicable federal and state laws, rules, and regulations. Invalidity of any portion of this Agreement under the law of the State of Texas or of the United States shall not affect the validity of the remainder of this Agreement.

§ 8.9 Contractor stipulates that Owner is a political subdivision of the State of Texas, and, as such, enjoys immunities from suit and liability as provided by the constitution and laws of the State of Texas. By entering into this Agreement, Owner does not waive any of its immunities from suit and/or liability, except as otherwise specifically provided herein, and as specifically authorized by law.

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

Matthew Morgan  
Chief Operations Officer/Associate Superintendent  
Facilities, Construction & Support Services  
Cypress-Fairbanks Independent School District  
11440 Matzke Road  
Cypress, Texas 77429  
Telephone: 281-517-2809  
Fax: 281-517-2114

Jesse Clayburn  
Assistant Superintendent of Facilities and Construction  
Cypress-Fairbanks Independent School District  
11440 Matzke Road  
Cypress, Texas 77429  
Telephone: 281-897-4057  
Fax: 281-897-3806



# FOR REFERENCE ONLY

## PROJECT MANAGER

Project Manager  
Cypress-Fairbanks Independent School District  
11430 Perry Road  
Houston, Texas 77064  
Telephone: 281-XXX-XXXX  
Fax: 281-897-3806

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

<< >>  
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§ 8.12 Neither the Owner's nor the Contractor's representative shall be changed without ten (10) days written notice to the other party.

## § 8.13 Other Provisions

§ 8.13.1 All terms "Bidders" and "Bids" are modified to "Proposers" and "Proposals".

§ 8.13.2 Contractor and each subcontractor and sub-subcontractor assigning hereby assigns to Owner any and all claims for overages associated with this Contract which arises under the Antitrust laws of the United States, 15 U.S.C.A. Section 1, et.seq (1973).

## ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101-2017, Standard Form of Agreement Between Owner and Contractor, as amended.

§ 9.1.2 The General Conditions are AIA Document A201-2017, General Conditions of the Contract for Construction as amended.

Document	Title	Date	Pages
Section CA	Application for Payment Checklist		
Section CB	Supplementary Conditions to the General Conditions of the Contract for Construction as Amended		
Section CC	Right to Audit		

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
Exhibit A	Forms AC, AE, AF, AG, AH, AN and Resumes		
Document	Title	Date	Pages
Exhibit B	Front End Documents Table of Contents		

§ 9.1.4 The Specifications:  
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

# FOR REFERENCE ONLY

« »

Section	Title	Date	Pages
Exhibit C	Specifications Table of Contents		

## § 9.1.5 The Drawings:

(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages
Exhibit D	Index of Drawings		

## § 9.1.6 The Addenda, if any:

Number	Date	Pages
Addendum No. 1		

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

## § 9.1.7 Additional documents, if any, forming part of the Contract Documents:

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, as amended provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

Section	Title	Date	Pages
Exhibit E	Section 01 35 23 Special Owner Requirements		
Exhibit F	Post Proposal Addendum No. X (If Applicable)		

## ARTICLE 10 INSURANCE AND BONDS

§ 10.1 The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2017, as amended and Section BD of the project specifications.

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

OWNER (Signature)

«Scott Henry, President of the Board of Trustees or  
Administrative Designee  
«Administrative Designee:  
Mr. Matthew Morgan,  
Chief Operations Officer/Associate Superintendent  
of Facilities, Construction & Support Services »

(Printed name and title)

CONTRACTOR (Signature)

« »  
« »  
« »  
« »  
« »  
« »

(Printed name and title)



# AIA® Document A201® – 2017

## General Conditions of the Contract for Construction

### for the following PROJECT:

*(Name and location or address)*

2024 Cy Creek HS Renovation  
CFISD Project Number: 24-02-5754R-RFP  
Architect Project No. 23-148.00

### CAMPUS ADDRESS:

9815 Grant Rd., Houston, Texas 77070

### THE OWNER:

*(Name, legal status and address)*

Cypress-Fairbanks Independent School District  
11430-B Perry Road  
Houston, Texas 77064  
Telephone Number: 281-897-4108  
Fax Number: 281-897-3806

### THE ARCHITECT:

*(Name, legal status and address)*

VLK Architects  
20445 TX-249, Ste 350  
Houston, Texas 77070  
281-671-2300

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### 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.

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11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
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## 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 as amended (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract, as amended (General, Supplementary and other Conditions), Performance Bond, Labor and Materials Payment Bond and Proof of Insurance, Contractor's Proposal, Drawings, Specifications, all Addenda issued prior to execution of 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 a Change Proposal Request, or (4) a written order for a minor change in the Work issued by the Architect.

#### § 1.1.2 The Contract

The Contract Documents form the Contract for Construction. This agreement, as amended, represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Construction Documents become part of the Contract when accepted by the Owner. All sections of the Project Manual shall be a part of the Contract, including any Proposal signed by the Contractor, and any Request for Proposals for the Project ("RFP"). The Contract may be amended or modified only by a written Modification signed by the Owner. 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 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, storage requirements 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.

*(Paragraphs deleted)*

#### § 1.1.7 The Project Manual

The Project Manual is a volume assembled for the Work which may include the bidding or proposal requirements, sample forms, Conditions of the Contract and Specifications.

#### § 1.1.8 Addenda

Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Proposal Documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction agreement is executed. The successful Contractor and his Subcontractors shall post all addendum items on their sets of Drawings and Specifications.

#### § 1.1.9 Approved Equal, Approved Equivalent or Equal

Init.

The terms Approved and Approved Equivalent relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.19 Substitution of Products and Systems for procedure which must be followed.

#### **§ 1.1.10 Proposal Documents**

Proposal Documents consist of all documents bound into or referenced in the Project Manual, the Drawings, and Addenda related thereto. The Project Manual contains the Proposal Requirements, Sample Forms, Conditions of the Contract, the Specifications, and a list of Drawings, and Schedules, some of which are bound into the Project Manual (Other Drawings and Schedules are bound separately).

#### **§ 1.1.11 Miscellaneous Other Words**

The terms "Bids" or "Bidding" mean Competitive Sealed Proposal, which by definition allows the Owner to accept the "best value" for the school district, based on factors other than cost.

### **§ 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.

*(Paragraph deleted)*

**§ 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.

#### **§ 1.2.4 Precedence of the Contract Documents**

The most recent issued Document takes precedence over the previous issued forms of the same Document. The order of precedence is as follows with the highest authority listed first.

- .1 The Agreement
- .2 The Addenda
- .3 Conditions of the Contract, Drawings and Specifications shall have equal authority. Should these documents disagree in themselves, the Architect will select the appropriate method for performing the work at no additional increase in the Contract Cost.

In the case of an inconsistency between the Drawings and Specifications or within either set of Documents discovered prior to Proposal Time but too late to be clarified by an Addendum, the better quality or greater quantity of work shall be included in the proposal. Clarification of the inconsistency will be accomplished with Contractor after award of the Contract, and if necessary, an appropriate reduction in the Contract will be accomplished by Change Order.

#### **§ 1.2.5 Relation of Specifications and Drawings**

The Drawings and Specifications are correlative and have equal authority and priority. Should they disagree in themselves, or with each other, base the proposals on the most expensive combination of quality or quantity of work indicated. The appropriate method of performing the Work, in the event of the above-mentioned disagreements, will be made by the Architect.

#### **§ 1.2.6 Optional Materials, Brands and Processes**

When more than one is specified for a particular item of Work, the choice shall be the Contractor's. The final selection of color and pattern will be made by the Architect from the range available within the option selected by the Contractor, unless the item is specified to match a specific color or sample furnished. Where particular items are specified only products of those named manufacturers are acceptable. Certain specified construction and equipment details may not be regularly included as part of the named manufacturer's standard catalog equipment but shall be provided by the manufacturer as required for the proper functioning of the equipment. Reasonable minor variations in equipment are expected and will be acceptable; however, indicated and specified performance and material requirements are minimum, and will be required in addition to standard accessories. The Architect reserves the right to determine the equality of equipment and materials that deviate from any of the indicated and specified requirements.

### **§ 1.2.7 Standards and Requirements**

When the Contract Documents refer to standards, building codes, manufacturers' instructions, or other documents, unless otherwise specified, then the current edition as of the date of execution of the Agreement by the last party to execute said Agreement shall apply. It shall be the responsibility of the Architect to address revisions or amendments to applicable codes or standards which arise after the date of execution of the Agreement and until Final Completion, pursuant to the terms of the Agreement between Owner and Architect. Requirements of public authorities apply as minimum requirements only and do not supersede more stringent specified requirements.

### **§ 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 Execution of Contract Documents**

**§ 1.5.1** The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

**§ 1.5.2** 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 to the Contract Documents. If an approved Contract Document requiring Contractor's signature has not been signed, then the missing signature shall be provided within a reasonable period of time. Failure of Contractor to sign an approved Contract Document after notice and a reasonable opportunity to sign, shall be considered a material breach of the Contract by Contractor.

### **§ 1.6 Ownership and Use of Drawings, Specifications and Other Instruments of Service**

**§ 1.6.1** The Drawings, Specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Construction Documents through which the Work to be executed by the Contractor is described. All ownership rights, whether common law, statutory, or other reserved rights, including copyright ownership of the Construction Documents, are controlled by the Agreement between the Owner and Architect. The Contractor may retain one record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect or the Architect's consultants. The Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this authorization shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect and the Architect's consultants. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of any copyrights or other reserved rights.

*(Paragraphs deleted)*

### **§ 1.7 Miscellaneous Other Definitions**

#### **§ 1.7.1 Alternate Proposal(s)**

A separate amount stated on the 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 a period of 120 days after receipt of proposals, unless otherwise modified, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

### **§ 1.7.2 Base Proposal**

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

### **§ 1.7.3 Contract Time**

The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is not subject to adjustment or extension without the written permission of the Owner.

### **§ 1.7.4 Date of Agreement**

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted on 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 the Work.

### **§ 1.7.5 Date of Commencement of the Work**

The commencement date shall be the date the contract award is approved by the CFISD Board of Trustees. This date constitutes day zero ("0") of Contract Time.

### **§ 1.7.6 Date of Final Completion**

The end of construction. Refer to Section 9.10.

### **§ 1.7.7 Day**

The following days are referenced in the documents:

- .1 Calendar Days: The days of the Gregorian Calendar. The Contract Time is established in Calendar Days and extensions of time granted for Regular Work Days lost, in excess of anticipated delay day allowance, will be converted to Calendar Days.
- .2 Holidays: The days officially recognized by the construction industry and/or Owner approved holidays, in this area as a holiday; normally limited to the observance days of New Year's Day, Martin Luther King, Jr. Day, Good Friday, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the Friday after, Christmas Eve, Christmas Day and New Year's Eve day.
- .3 Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested, after expenditure of the Anticipated Delay Day Allowance, 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). The Contractor is advised to refer to Section 01 35 23.1, Special Owner Requirements regarding after hours use of the premises.
- .4 Anticipated Delay Days Allowance: An allowance of Fifteen (15) Regular Work Days per year (or two (2) regular work days per month, whichever is less) is established as probable days lost due to delays beyond the Contractor's control. This allowance includes District testing dates and any other days the district directs the contractor to not perform work due to unspecified campus events. This additional Delay day allowance does not include anticipated weather days as indicated in section 8.3., also does not include Holidays as indicated in Section 1.7.7.2. These days for weather and holidays are to be added to this additional delay day allowance and are to be calculated in accordance with their respective section as indicated elsewhere in these general conditions to establish the grand total of the anticipated delay day allowance.
- .5 Evaluation of Delay Days: The Architect and Owner will evaluate delays claimed by the Contractor based on the Critical Path of the Contractor's construction schedule, and if the Architect is in agreement that a Critical Path task has been delayed due to circumstances beyond the Contractor's control, the accepted delay days will be deducted from the Anticipated Delay Day Allowance.
- .6 Delay Days: Regular Work Days when circumstances beyond the Contractor's control prevent progress on major portions of the Work as described in Paragraph 8.3, Delays and Extensions of Time, in the General Conditions of the Contract for Construction.

### **§ 1.7.8 Notice to Proceed**

A notice that may be given on behalf of the Owner to the Contractor, through the Architect, that directs the Contractor to start the Work. It also establishes the Date of Commencement of the Work.

### **§ 1.7.9 Provide**

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



### **§ 1.7.10 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. Refer to Article 9.8.

## **ARTICLE 2 OWNER**

### **§ 2.1 General**

**§ 2.1.1** The Owner is the independent school district identified in the Contract Documents. The Board of Trustees, by majority vote, is the only representative of the Owner, an independent school district, having the power to: enter into a contract; amend a contract; approve changes in the scope of the Work; approve and execute a Change Order or Construction Change Directive modifying the Contract Sum; agree to an extension to the date of Substantial or Final Completion; or terminate a contract. The Board designates authorized representatives to act on its behalf for day-to-day operations under the Contract. Unless otherwise designated in the Contract Documents, Owner's authorized representative shall be the Superintendent of Schools, who may delegate responsibilities as appropriate. Owner's Board of Trustees hereby delegates to the Superintendent of Schools or designee the authority to approve changes to the Work where such changes are within the Owner's Betterment Allowance or other designated Allowances stipulated in the Contract Documents and also the authority to approve any Change Order which does not exceed \$249,999.99 and the authority to approve any and all time extensions to the Contract. Any Change Order that is valued at or above \$250,000 shall require Board approval in accordance with Local Board Policy. Except as otherwise provided in the Contract Documents, the Architect does not have such authority. Neither Architect nor Contractor may rely upon the direction of any employee of Owner who has not been designated in writing in the Contract Documents. Owner shall not be financially responsible for actions taken by the Architect or Contractor in reliance upon direction from unauthorized persons.

**§ 2.1.2** It shall be distinctly understood that by virtue of this Contract, neither the Contractor nor any contractor, subcontractor, sub-subcontractor, consultant, design professional, mechanic, material person, artisan, or laborer, skilled or unskilled, shall ever in any manner have, claim, or acquire any lien upon the buildings or any of the improvements of whatsoever nature or kind so erected or to be erected by virtue of this Contract or upon any of the land on which said buildings or any of the improvements are so erected, built, or situated. It shall be further understood that this Contract is not written for the benefit of third parties nor shall it be construed to create any third party beneficiaries.

### **§ 2.2 Information and Services Required of the Owner**

**§ 2.2.1** Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.2** 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.

**§ 2.2.3** 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 reasonably rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work, shall exercise due diligence in attempting to located underground utilities, and shall notify the Owner and Architect of any discrepancies between the surveys and actual conditions of the site that Contractor observes or should observe in the exercise of ordinary care.

**§ 2.2.4** 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.

**§ 2.2.5** Refer to Section CB, Supplementary Conditions, for quantities of plans and project specifications to be furnished to the Contractor.

### **§ 2.3 Owner's Right to Stop the Work**

*(Paragraphs deleted)*

**§ 2.3.1** 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.

### **§ 2.4 Owner's Right to Carry Out the Work**

**§ 2.4.1** If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within seven (7) Calendar Days 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, immediately correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to 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.

### **§ 2.5 Owner's Right to Occupy the Project**

**§ 2.5.1** 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 have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents and Contractor shall be responsible for insurance, utilities and security until Substantial Completion of the entire project.

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

## **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 in a good and workmanlike manner and in an expeditious and economical manner consistent with the interest of the Owner; shall exercise the degree of care, skill, and diligence in the performance of the Work in accordance with and consistent with industry standards for similar projects; shall utilize its best skill, effort, and judgment in diligently performing the Work; and shall furnish efficient business administration and supervision. Workmanship shall be of a quality to produce satisfactory results.

**§ 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.

### **§ 3.2 Review of Contract Documents and Field Conditions by Contractor**

**§ 3.2.1** The Contractor shall carefully study and compare the Agreement, Conditions of the Contract, Drawings, Specifications, Addenda, Modifications, and information provided by the Owner and shall at once report to the Architect any error, inconsistency, or omission he may discover. Contractor shall be liable for any damage to Owner for failure to report any error, inconsistency or omission he may discover or should have discovered, but he shall not be liable to Owner or Architect for any damage resulting for such error, inconsistency or omission which he did discover and at once so reported. Contractor shall not perform any work without approved Drawings and Specifications issued by the Architect.

**§ 3.2.2** Any design errors or omissions noted by the Contractor during this review shall be reported promptly to the Architect, but 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. The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, but any nonconformity discovered by or made known to the Contractor shall be reported promptly to the Architect.

**§ 3.2.3** If the Contractor believes that additional cost or time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to Sections 3.2.1 and 3.2.2, the Contractor shall make Claims as provided in Sections 4.3.6 and 4.3.7. If the Contractor fails to perform the obligations of Sections 3.2.1 and 3.2.2, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. The Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents or for differences between field measurements or conditions and the Contract Documents unless the Contractor recognized such error, inconsistency, omission or difference and knowingly failed to report it to the Architect.

*(Paragraphs deleted)*

**§ 3.2.4** The Contractor shall take field measurements and verify field conditions and shall carefully compare such fields measurements and conditions and other information known to the Contractor with the Contract documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

**§ 3.2.5** The Contractor shall not be entitled to additional compensation for the "rework portion" of any additional work caused by his failure to carefully study and compare the contract documents prior to execution of the Work.

**§ 3.2.6** The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work complies with the Contract Documents. The Contractor shall arrange meetings prior to commencement of the work of all major subcontractors to allow the subcontractor to demonstrate his understanding of the documents to the Architect/Owner and to allow the subcontractor to ask for any interpretation he may require.

**§ 3.2.7** 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 above requirements before additional services are performed.

**§ 3.2.8** 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 substitution 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, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning

construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. 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 Contractor shall not be responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

**§ 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.

**§ 3.3.3.1** The Contractor is especially cautioned to coordinate the routing of all mechanical, plumbing and electrical items and provide coordinating drawings in accordance with provisions of the Contract Documents prior to commencing these operations.

**§ 3.3.4** Contractor shall document existing facility conditions and systems onsite prior to performing any work with video recording and/or photographs and shall test said systems to identify any pre-existing deficiencies in the presence of the Owner, Architect/Engineer. Any items not noted or identified in this documentation or brought the attention of the Owner in writing will be assumed to be in working order and any problems with such systems will be the responsibility of the Contractor to correct and repair to the pre-contract condition or better.

**§ 3.3.5** Prior to performing any work, the Contractor shall locate all utility lines as shown on the plans and specifications, including telephone company lines and cables, sewer lines, water pipes, gas lines, and electrical lines, and shall perform the Work in such a manner as to avoid damaging any such lines, cables, pipes and pipelines. In addition, the Contractor shall independently determine the location of same.

#### **§ 3.4 Labor and Materials**

**§ 3.4.1** Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, eligible to work in accordance with state and federal law. In addition, unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for 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** Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with prior written consent of the Owner, after evaluation by the Architect and in accordance with a Change Order, Construction Change Directive, or Change Proposal Request.

**§ 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.

#### **§ 3.5 Warranty**

*(Paragraphs deleted)*

**§ 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 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 by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, 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.

The Contractor is solely responsible for, and shall provide written proof of maintenance, service, and protection of materials and equipment installed prior to Substantial Completion.

**§ 3.5.2** In the event of failure of materials, products, or workmanship, either during construction or the warranty period (as specified in Section 3.5.5), the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Architect. Items of work first performed after Substantial Completion shall have their warranties extended by the period of time between Substantial Completion and the actual performance of the Work. Such warranties shall be submitted to owner in writing, documenting such time extensions. This warranty period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the work.

**§ 3.5.3** Contractor shall establish a spreadsheet-type Warranty Work tracking format included in the Project Manual and shall verify and certify completion of each warranty work item.

**§ 3.5.4** Approximately six (6) and eleven (11) months after Substantial Completion, the Contractor shall accompany the Owner and Architect on a complete re-inspection of the Project and be responsible for correcting any additional deficiencies observed or reported, including any uncompleted Punch List Items or outstanding or incomplete Warranty Items.

**§ 3.5.5** The Warranty Period for this Project is One (1) Year from the date of Substantial Completion except for any extended warranties as specified herewith in the Contract Documents

**§ 3.5.6** The warranty period shall extend one (1) year on specific items of work (materials and labor) if warranty work is performed on a specific item or work that requires the issuance of a second warranty work request within ninety (90) days after the original warranty work request was issued.

**§ 3.5.7** Warranty work shall be performed within ten (10) working days after the Contractor receives a request for warranty work, except where immediate responses are required as described below:

- .1** For work which is identified as affecting life safety, fire alarm or security of the occupants and/or the facility on the warranty request, on-site corrective work shall begin immediately after receipt of the warranty work request by the Contractor, 365 days per year, twenty-four (24) hours per day.
- .2** For work affecting the operation of the HVAC system, domestic water heaters, elevators and food service equipment (except walk-in refrigeration and/or freezer equipment), on-site corrective work shall begin within six (6) hours of Contractor's receipt of warranty work, 365 days per year 24 hours per day.
- .3** For walk-in refrigeration and/or freezer equipment, on-site corrective work shall begin within four (4) hours of Contractor's receipt of warranty work, 365 days per year, 24 hours per day.

**§ 3.5.8** For warranty work requiring immediate response as described in 3.5.7 above, the Contractor shall maintain or contract for an answering service available 365 days per year, 24 hours per day.

**§ 3.5.9** Warranty work shall be completed within six (6) hours after the initiation of on-site corrective work unless additional time is reasonably required, and the Owner has agreed on the additional time frame deemed necessary by the Contractor.

**§ 3.5.10** The Owner reserves the right to complete any warranty work that Contractor fails to complete in the specified time period. Owner will backcharge Contractor for the cost of such work, including Consultants' fees.

## **§ 3.6 Taxes**

**§ 3.6.1** The Owner is exempt from the Texas Sales Tax on any purchase of tangible personal property and utilities and will issue Certificates of Exemption from the Texas Sales Tax on materials furnished by Contractors on School Construction projects. The Contractor shall give a written statement to the Owner (with a copy to the Architect) as to the proration of costs of skilled crafts, labor and materials for the project prior to awarding of a Construction Contract. The Contractors shall obtain Certificates of Resale from their suppliers in order to avoid payment of the State Sales Tax on materials incorporated in School jobs. Failure of the Contractor to obtain Certificates of Resale from their suppliers shall make the Contractor responsible for absorbing the tax.

### § 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.

§ 3.7.1.1 The Owner will pay directly or to the governing authority directly from the Allowance, the cost of all permanent connection charges, including water and sewer tap charges and the provision and installation of the irrigation meter and the domestic water meter and vault. The Owner will pay directly to the governing authority the cost of all non-taxable entity fees, capacity charges, drainage impact fees and permanent utility account deposits.

§ 3.7.1.2 The Contractor shall pay directly all temporary utility connection charges, including utility district/company inspection, survey, and permit fees for both temporary and permanent connections.

§ 3.7.1.3 The Contractor shall include in the Base Proposal, the cost for providing all backflow preventers, fire sprinkler system backflow preventers, meters, vaults, valves, taps, and piping from taps for domestic water, irrigation, and fire sprinkler systems.

§ 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 It is neither the Contractor's responsibility nor the Owner's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations. However, if the Contractor observes or should have observed, that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification.

*(Paragraphs deleted)*

§ 3.7.4 If the Contractor performs Work which he knew or should have known it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

### § 3.8 Allowances

§ 3.8.1 The General Contractor shall include in his proposal all allowances stated in the Specifications.

These stated allowances represent the cost estimate of the materials and equipment delivered and unloaded at the site. The Contractor's supervision, handling costs, estimating costs, miscellaneous fees, overhead, profit, clean-up, as-builts, warranty, and other expenses contemplated for the allowance material and equipment shall be included in allowances only where called for in the various sections of these specifications.

The Contractor shall purchase the allowance materials and equipment as directed by the Architect, upon approval by the Owner, on the basis of the lowest reasonable proposal of at least three (3) competitive proposals unless otherwise directed by Owner. If the actual cost of the materials and equipment delivered and unloaded at the site is more than all the allowance estimates, the Contract Sum will be adjusted by Change Order.

§ 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, miscellaneous fees, 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 in sufficient time to avoid delay of the Work.

### **§ 3.9 Superintendent**

**§ 3.9.1** The General Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work including punch list work. The Superintendents and Project Manager shall be satisfactory to the Owner and Architect and shall not be changed except with the consent of the Owner and Architect, unless the Superintendent leaves the employment of the Contractor. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architects objects to any nominated superintendent or project manager. The superintendent and project manager shall represent the Contractor, and communications given to the superintendent and/or project manager shall be as binding as if given to the Contractor.

*(Paragraphs deleted)*

**§ 3.9.2** The Contractor shall furnish to the Owner and the Architect in writing the names and professional qualifications of the persons proposed by the Contractor as the project manager and superintendent with the submitted proposal. The Contractor shall not assign nor substitute any person as the project manager or superintendent to whom the Owner or the Architect has made reasonable objection. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architect objects to any nominated project manager and/or superintendent. The Contractor's submittal of the project manager and superintendent's professional qualifications with his proposal represent the Contractor's acknowledgement that the selection committee's evaluation of the Contractor's proposal includes said superintendent's qualifications and the understanding that said job superintendent will remain on site, full time, until the Architect and Owner have agreed that all punch list work has been completed. See also, Specification Section 01 35 23 – Special Owner Requirements, for additional job superintendent requirements. In addition, the Owner reserves the right to perform a criminal records history review of the proposed superintendent and other Contractor personnel prior to the Contract Award as may be deemed necessary.

**§ 3.9.3** Contractor will be required to keep the job superintendents on each job-site during the course of the construction until completion of all punch list items. In the event the job superintendents is absent from any job site at any time during the project contract time or during punch list completion and an agreed upon substitute is not provided, the Owner may backcharge the Contractor \$250.00 per occurrence.

**§ 3.9.4** The Contractor shall notify the Owner and Architect at the beginning of the work day if the superintendent is out sick. If the superintendent is to be out for any other reason, the Owner and Architect are to be notified at least 24 hours in advance. In both cases the Owner and Architect are to be informed of the name of the acting superintendent.

### **§ 3.10 Contractor's Construction Schedules**

**§ 3.10.1** The Contractor shall, within the time frame specified in Section 01 32 16, prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

**§ 3.10.2** The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be 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, 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 will provide a detailed critical path construction schedule including milestones for this project within the time frame specified in 01 32 16. This schedule shall be prepared using "Suretrak, Primavera, Microsoft Project" or other similar scheduling software. In addition, the Contractor shall submit to the Owner and Architect with each monthly Application for Payment a copy of the progress schedule showing all modifications required to have the schedule reflect appropriate revisions and shall take whatever action is necessary to assure that the project completion schedule is met. The Contractor is required to attend and to give a schedule update at each weekly construction administration meeting and shall provide a detailed 3 week work ahead schedule. The progress schedule will include

percentages of work completed to date along with percentages of work remaining to be completed. These percentages will be used in the verification of the Contractor's monthly Application for Payment. Pay Applications will not be processed by the Owner unless accompanied by an updated progress schedule. If the project is behind schedule, specific input will be required from the Contractor on how he intends to make up the time. If the project remains behind schedule for more than ten (10) working days, for any reason, the Owner, Architect, and Consultants and their associated personnel, shall be compensated by the Contractor, at their standard hourly billing rate, which will be provided as required, until such time as the Contractor can successfully demonstrate to all parties that the project is back on the agreed schedule. Contractor shall provide two (2) large format color prints one (1) for Owner and one (1) for jobsite of the construction schedule monthly with all items showing current status and original baseline schedule.

### **§ 3.11 Documents and Samples at the Site**

The Contractor shall maintain at the site for the Owner one (1) copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one (1) copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### **§ 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 the way by which 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.

**§ 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, (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents, and (4) coordinated said shop drawings, product data, samples and submittals with adjacent work and its related submittals to be compatible and not in conflict for installation.

**§ 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 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 requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing 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 thereof, except for any such errors or omissions which are within the Architect's statutory or contractual design responsibility.

**§ 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 written notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 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. 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 cause such services or certifications to be provided by a properly 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, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, 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. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

*(Paragraphs deleted)*

**§ 3.12.11** If, in the opinion of the Architect, the Shop Drawings are incomplete, indicate an inadequate understanding of the work covered by the Shop Drawings, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of any of the above deficiencies and subsequent resubmittal. Additional service charges may be charged to the Contractor by the Architect in this event.

**§ 3.12.12** The Contractor shall submit drawings, data and samples to the Architect at least fifteen (15) Regular Work Days prior to the date the Contractor needs the reviewed submittals returned. The Architect and his consultants will be allowed fifteen (15) Regular Work Days for checking from date of submission of shop drawings that are acceptable and do not require re-submission in the opinion of the Architect. Where colors are to be selected by the Architect, submit all product color 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 eight (8) weeks [four (4) weeks for a summer remodel] of the Contractor's receipt of Notice to Proceed on the Project.

**§ 3.12.13** The Contractor shall submit the number of copies of product data and samples which the Contractor and his subcontractors need for their use PLUS two (2) additional sets for the Architect, two (2) additional set for the Owner; one (1) additional set for each of the Architect's consultants involved with the particular Section of Work; (1) additional set of all mechanical shop drawings for TAB and one (1) additional set to be added to each copy of the Owner's Operation and Maintenance manuals at substantial completion. If, in the opinion of the Architect, the Shop Drawings are incomplete; indicate an inadequate understanding of the work covered by the Shop Drawings; or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the Shop Drawings will be returned, unchecked, to the Contractor for correction of these deficiencies and subsequent resubmittal. Additional service charges as outlined in Article 3.2.7 may be charged to the Contractor by the Architect in this event.

**§ 3.12.13.1** Where shop drawings are involved, submit one (1) high quality reproducible transparency and one (1) opaque print of the shop drawing for the Architect plus one (1) additional opaque print for each of the Architect's consultants involved with the particular Section of Work and one (1) additional print for each copy of the Owner's Operation and Maintenance Manuals to be submitted at Substantial Completion. The reproducible transparency will be marked by the Architect and/or his consultants and returned to the contractor for his use, distribution, correction or resubmittal, as

required. After final review and correction of the submittal, the Contractor shall send one (1) corrected set to the Architect and one (1) to each of the Architect's consultants involved with the particular Section of Work. Contractor shall also retain one (1) set of all reviewed Mechanical submittals to be transmitted to the HVAC Test and Balance agency selected by Owner.

**§ 3.12.14** The Contractor shall deliver in one (1) submittal, all material samples requiring a color selection by the Architect, within eight (8) weeks [four (4) weeks for summer remodel] of the Contractor's receipt of a Notice to Proceed on the Project. The Architect will return material color selections within six (6) weeks [three (3) weeks for summer remodel] of receipt of the color samples from the Contractor.

**§ 3.12.15** The Contractor shall produce and submit for review, composite coordination drawings within four (4) weeks of the Contractor's receipt of a Notice to Proceed on the Project. The composite coordination drawings shall depict the coordination of all structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping in a composite above ceiling plan and a composite mechanical and electrical equipment room floor plan. Plans shall be produced at a scale of one-quarter (1/4") per foot and shall include larger scale sections with vertical elevations of elements required to confirm coordination of all elements. A schedule value for the production of the composite coordination drawings shall be included in the Continuation Sheet of the Application and Certificate for Payment for each of the Divisions of trade. Refer to specification section 01 31 13 for detail coordination document requirements.

### **§ 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, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

**§ 3.13.1** Contractor shall ensure that the Work, at all times, is performed in a manner that affords Owner reasonable access, both vehicular and pedestrian, to the site of the work and all adjacent areas. The Work shall be performed in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building material and equipment likely to cause hazardous conditions. Without limitation of any other provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of any area of the building adjacent to the site of the Work, or the building, in the event of partial occupancy.

**§ 3.13.2** Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including without limitation, lavatories, toilets, entrances, and parking areas, other than those designated by the Owner. The Contractor shall comply with all rules and regulations established by the Owner in connection with the use and occupancy of the Project site and the Building.

### **§ 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 and patching shall be restored to the condition existing prior to the cutting, fitting and 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 such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### **§ 3.15 Cleaning Up**

**§ 3.15.1** The Contractor shall, on a daily basis, keep the premises and surrounding area free from accumulation of waste materials or 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. See specification section 01 71 50 for specific requirements of final cleaning.

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

*(Paragraphs deleted)*

**§ 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; clean roofs; 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 a job site plan and 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 such 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 the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

### **§ 3.18 Indemnification**

**§ 3.18.1** To the fullest extent permitted by law and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability insurance purchased by the Contractor in accordance with Section 11.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, Third Party consultants, utility service providers involved with the project, 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 which would otherwise exist as to a party or person described in this Section 3.18.

**§ 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.

### **§ 3.19 Substitutions of Materials, Products, or Systems**

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

**§ 3.19.2** If, prior to submitting his Proposal, a Proposer at any level determines that any of the materials, 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 Proposer shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes shall be set forth in an addendum.

**§ 3.19.3** The Architect does not bind himself to consider a substitution during the proposal period unless written

request has been submitted to the Architect for approval at least ten (10) days prior to the date for receipt of Proposals. Each such request shall include a "side-by-side" comparison which may include but is not limited to the following; a complete description of the proposed substitute, the name of the material, project, or system for which it is proposed to be substituted, drawings, cuts, performance and test data and any other data or information necessary for a complete evaluation. Incomplete submittals will not be evaluated. If the Architect approves any proposed substitution, such approval will be set forth in an Addendum.

**§ 3.19.4** If, after award of contract, the Contractor or one of his Subcontractors or Suppliers determine 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 accomplished by appropriate modification.

### **§ 3.20 Record Drawings**

**§ 3.20.1** Within seven (7) days after substantial completion of the project, the Contractor shall submit two (2) sets of full-size photocopies of the Job Superintendent's field set of marked plans and specifications.

**§ 3.20.2** The Contractor shall provide the Owner with Electronic Record Drawings on a thumb drive or solid-state media drive. Drawings shall mirror the construction document sheets with any additions and changes made during the course of the project. Drawings shall be in both AutoCAD version 18 or later, and PDF or Tiff Format. CAD files shall have all referenced drawings in the same directory or folder. The record drawings shall include electronically all changes made during construction, clouded and keyed to identify the instrument of the change, Change Proposal Request or Change Order. For underground utility piping, revised locations shall also be dimensioned from the column grid lines. The record drawings must be delivered to the Architect at least thirty (30) days prior to receipt of the Contractor's Final Application for Payment. The record drawings shall have a statement added to indicate the purpose of the drawings (i.e. "RECORD DRAWINGS") and shall delete the Architects and/or Engineers seal. See additional requirements in Form 'AO'.

**§ 3.20.3** The Contractor is to provide the Owner with Record Specifications (one (1) PDF format on thumb drive or solid-state media drive) which denotes the manufacture of materials incorporated into the Project where more than one acceptable manufacturer is listed, and shall include all changes made during construction, clouded and keyed to identify the instrument of change. The record specifications shall have a statement added to indicate the purpose of the specifications (i.e. "RECORD SPECIFICATIONS"). See additional requirements in Form 'AO'.

### **§ 3.21 Antitrust Violations**

**§ 3.21.1** To permit the Owner to recover damages suffered; in antitrust violations, the Owner/Contractor Agreement shall include the following wording, "Contractor hereby assigns to Owner any and all claims for overcharges associated with this contract which are under the antitrust laws of the United States, 15 U.S.C.A., Sec. 1 et.seq. (1973)". The Contractor shall include this provision in his agreements with each subcontractor and supplier. Each subcontractor shall include such provisions in agreements with sub-subcontractors and suppliers

### **§ 3.22 Prevailing Wage Rates**

**§ 3.22.1** No employee used in this construction may be paid less than the minimum wage rate provided herein in Article 15.

### **§ 3.23 Construction Progress Photographs**

**§ 3.23.1** Contractor shall provide color construction progress photographs during the construction period on a monthly basis to the Architect and Owner. Photographs and digital files on thumb drive or solid-state media drive of photos shall be provided. Construction progress monthly photographs (24 minimum per month, showing all aspects of work accomplished during that month) shall be provided with each and every application for payment.

**§ 3.23.2** For New Construction, Building Additions and Miscellaneous Renovations provide (Digital files on thumb drive or solid-state media drive):

Two (2) aerial photographs prior to construction

Two (2) aerial photographs after Final Completion, and

Two (2) aerial photographs of the District facility site each month that there is a change in appearance of the

building exterior and site, or as requested by the Owner.

#### **ARTICLE 4 ADMINISTRATION OF THE CONTRACT**

##### **§ 4.1 Architect**

**§ 4.1.1** The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

**§ 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.

**§ 4.1.3** If the employment of the Architect is terminated, the Owner shall employ a new Architect against whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the former Architect.

**§ 4.1.4** Except as expressly provided herein, the Contractor shall not be relieved of Contractor's obligation to perform the Work in strict accordance with the Construction Documents and the Contract Documents by the duties, responsibilities, or activities of the Architect.

##### **§ 4.2 Architect's 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 (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the one-year period for correction of Work described in Section 12.2. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents unless otherwise modified in writing in accordance with other provisions of the Contract.

**§ 4.2.2** The Architect shall visit the site at least twice per week (or more per week when deemed necessary by the Owner's Superintendent or Designee or when necessary to protect Owner's interests) and at any other intervals appropriate to the stage of construction, to inspect the progress, quantity and quality of the Work completed, to reject any observed nonconforming Work, and to determine if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Construction Documents and the Contract Documents and on time. Furthermore, a minimum of two job site meetings per month from commencement of construction through Final Completion will be initiated by the Architect and attended by the Contractor. Attendees will include Owner, the Contractor's project manager and/or superintendent, Architect's project representative, and Architect. The Architect, Owner and their representatives shall at all times have access to the Work. Architect, or its structural consultant will provide on-site observation prior to and during all concrete pours that contribute to the structural integrity of the building, including all pours of concrete piers, footings, grade beams, floor slabs, and concrete superstructure components, if applicable. In addition, Architect or its structural consultant will provide on-site observation prior to covering up or closing up of portions of the construction, which if covered, would conceal problems with the structural integrity of the Project. Contractor shall not close or cover said Work until said observations have occurred. Contractor or Architect will advise Owner of the need for any third-party laboratory or testing services to assist the Architect and Owner. On the basis of the on-site observations by Architect, Architect shall keep Owner and Contractor informed of the progress and the quality of the Work, through Architect's field reports, and shall guard Owner against defects and deficiencies in the Work. Architect shall promptly notify Owner and Contractor, orally, regarding any defect or nonconforming Work, which shall be followed by notice in writing of defects or nonconforming Work noted and corrective action taken or recommended. The Architect, however, shall not have control over, or responsibility for the Contractor's construction means, methods, techniques, sequences, procedures, or safety programs, but this does not relieve Architect of Architect's responsibilities under this Agreement. Any services by Contractor made necessary by Contractor's construction defect or nonconforming Work, shall be performed at no additional cost to Owner.

**§ 4.2.3** The Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) 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. The Architect shall endeavor to guard the Owner against defects and deficiencies in the Work.

#### **§ 4.2.4 Communications Facilitating Contract Administration**

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

**§ 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 has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. 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.

**§ 4.2.7** The Architect will review, 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 as to cause no delay in the work or in the activities of the Owner, Contractor, or Subcontractor, 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, unless otherwise specifically stated by the Architect, 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, Change Proposal Requests, and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4.

**§ 4.2.9** The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; will 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, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

**§ 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.

**§ 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. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

**§ 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.

§ 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.

§ 4.2.14 The Contractor shall not cover up any work without the Architect and Owner performing an observation of such work. The Contractor will be responsible for any and all associated costs to allow for observations of the work, uncovered, by the Architect and Owner if the Contractor covers work without either the consent of the Architect and Owner or without providing the Architect and Owner with reasonable opportunity to observe the work, whether or not such work is found to be acceptable by the Architect or Owner.

### § 4.3 Claims and Disputes

§ 4.3.1 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. Claims must be initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.3.2 Time Limits on Claims. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be initiated by written notice to the Architect and the other party.

§ 4.3.3 Continuing Contract Performance. Pending final resolution of a Claim unless as otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract.

§ 4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which 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, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if 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 an equitable adjustment 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 so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within twenty-one (21) days after the Architect has given notice of the decision. If the conditions encountered are materially different, the Contract Sum and Contract Time shall be equitably adjusted, but if the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.4.

§ 4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.6.

§ 4.3.6 If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with this Section 4.3.

### § 4.3.7 Claims For Additional Time

§ 4.3.7.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein 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.

§ 4.3.7.2 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.

§ 4.3.8 Injury or Damage to Person or Property. If either party to the Contract 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, written notice of such 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.

§ 4.3.9 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 4.3.10 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 without limitation:

- .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 4.3.10 shall be deemed to preclude an award of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

#### § 4.4 Resolution of Claims and Disputes

§ 4.4.1 Decision of Architect. Claims, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for recommendation. If the parties are unable to agree, an appeal may be submitted as stated in Section 4.4.1.1 below.

§ 4.4.1.1 Any claim, disputes or matters arising out of this contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

§ 4.4.2 The Architect will review Claims and within ten (10) days of the receipt of the Claim take one or more of the following preliminary actions: within ten (10) days of receipt of claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating the reasons for rejection, (4) recommend approval of the Claim by the other party, or (5) suggest a compromise.

§ 4.4.3 In evaluating Claims, the Architect 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 Architect in rendering a decision. The Architect may request the Owner to authorize retention of such persons at the Owner's expense.

§ 4.4.4 If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten (10) days after receipt of such request, and shall either provide a response on the requested supporting data, advise the Architect when the response or supporting data will be furnished or advise the Architect that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Architect will either reject or approve the Claim in whole or in part.

§ 4.4.5 The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be final and binding on the parties but subject to mediation.



§ 4.4.6 Upon receipt of a Claim against the Contractor or at any time thereafter, the Architect or 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 Architect or the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.4.7 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 prior to resolution of the Claim by the Architect, or by mediation.

§ 4.4.8 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven (7) days.

Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be possibility of a Contractor's default, the Architect shall notify the surety and request the surety's assistance in resolving the Claim.

## § 4.5 Mediation

§ 4.5.1 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 4.3.10, 9.10.4 and 9.10.5 shall, after initial decision by the Architect or 30 days after submission of the Claim to the Architect, be subject to mediation only upon the mutual consent of both parties. In the event that mutual consent is not achieved, the parties are free to pursue any claims, disputes or matters in any manner allowed by law.

§ 4.5.2 Mediation, 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 and with the American Arbitration Association.

§ 4.5.3 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.

## 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.

§ 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

*(Paragraph deleted)*

§ 5.2.1 As soon as practicable after award of the Contract, but not later than five (5) days prior to the submittal date for the Contractor's first Application for Payment, the Contractor shall furnish in writing to the Owner and the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. Where subcontractors have been listed in the Specifications or on the Contractor's Proposal Form, the proposed entities shall be those firms listed in the Specifications and on the Contractor's Proposal Form, unless an agreement has been reached with the Owner to accept a proposed substitute(s). The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no objection. Failure of the Contractor to submit the subject names in a timely manner will delay processing of the Contractor's Application for Payment.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made a timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made an objection under provisions of Subparagraph 5.2.1.

§ 5.2.3 If the Contractor has acted promptly and responsibly in submitting names as required, and the Owner or Architect objects to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no objection. The Contract Sum 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.

§ 5.2.4 Prior to any substitution of a subcontractor by the Contractor, the Contractor shall notify the Architect of his intent and reasons for such proposed substitutions. The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect objects to such change.

*(Paragraphs deleted)*

§ 5.2.5 The Contractor shall submit the list of proposed Subcontractors on AIA Document G805 or the form provided in the Project Manual.

§ 5.2.6 The Contractor is required to visit the site and completely familiarize himself with the existing conditions prior to the proposal. Neither additional increase in the Contract Sum nor extension in Contract Time will be granted when existing or known conditions require a certain amount of work to comply with the intent of the Contract Documents.

### § 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, 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, which the Contractor, by these 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. 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. Each subcontractor shall provide proof of insurance to Contractor consistent with the Contractor's insurance to Owner and in an amount commensurate with the Work to be performed by the Subcontractor.

### § 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 in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

§ 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.

*(Paragraph deleted)*

§ 5.5 Neither the Owner nor the Architect shall be obligated to pay or to ensure the payment of any monies to subcontractors due to any non-payment to the Contractor or non-payment of subcontractors by the Contractor.

## **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 Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Section 4.3.

**§ 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 other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the 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, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor 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 report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report 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, except as to defects not then reasonably discoverable.

**§ 6.2.3** The Owner shall be reimbursed by the Contractor for costs incurred by the Owner which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction of a separate contractor.

**§ 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, Change Proposal Request, Construction Change Directive, order for a minor change in the

Work, or a Change Proposal Request issued by Architect or Contractor, signed by Owner, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

**§ 7.1.2** All Change Orders and Change Proposal Requests shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Change Proposal Request 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.

**§ 7.2.2** The parties mutually may agree upon a Change Order that adjusts Contract Time and/or Contract Sum based on a change in the Scope of Work requested by the Owner or that results from unanticipated, extraordinary adverse weather conditions as described in Article 15 of these General Conditions. The parties further agree that Contractor shall proceed with the Work only as set forth in a Change Order upon Contractor's physical receipt of a Change Order duly executed by the Owner. Contractor shall be entitled to reimbursement of a previously agreed to cost for estimating services.

**§ 7.2.3** If a change in the Work is to be ordered, a written request shall be issued by Owner to Contractor describing the change and requesting the submission of a Change Order Request. When time does not permit the processing of a Change Order in advance of commencing the change in the Work, upon receipt of a written authorization from Owner, Contractor shall proceed with a change in the Work pursuant to a Construction Change Directive and Contractor shall concurrently proceed with submission of a Change Order Request.

**§ 7.2.4** Within thirty (30) days following receipt of a written request, Contractor shall submit a Change Order Request to Owner together with the revised or new documents which, if approved, will become part of the Contract Documents setting forth any requested adjustment in the Contract Sum or the Contract Time, and including an itemization of all costs of material and labor with extensions listing quantities and total costs, and a substantiation of any Claim for an extension of the Contract Time. Any Change Order for a change in the work must be signed by the Owner before the Owner is obligated for payment related to the Change Order. If Contractor is unable to submit the above information within the time limit, it shall notify Owner in writing, setting forth for Owner's approval a date by which Contractor will submit the information as well as a schedule for the performance of the Work for which a Change Order Request will be forthcoming. If within the 30 days the Construction Manager cannot ascertain the financial or time impact of a claim a letter alerting the Owner of a forthcoming claim will suffice. This must be sent during this 30-day window.

**§ 7.2.5** If Owner accepts a Change Order Request submitted by Contractor, Contractor shall prepare a Change Order that is based upon such Change Order Request for execution by Contractor and Owner and to the extent that the Owner and Contractor agree, the Contract Sum and Contract Time shall be adjusted as provided in the Change Order upon execution of such Change Order.

**§ 7.2.6** Nothing contained herein shall limit the right of Owner to order changes in Work by Change Orders that have not been signed by Contractor, and Contractor shall promptly perform all Work required under the Contract Documents or a Change Order despite its failure to execute the Change Order. However, the Owner shall issue and execute a Change Order authorizing payment for all undisputed amounts.

**§ 7.2.7** No change in the Work shall be the basis of an addition to the Contract Sum or a change in the Contract Time unless and until such change has been authorized by a Change Order executed and issued by the Owner in accordance with the Contract Documents. Changes in the Work may be made without notice to Contractor's sureties and absence of such notice shall not relieve such sureties of any of their obligations to Owner.

§ 7.2.8 Acceptance of a Change Order by the Contractor shall constitute full accord and satisfaction for any and all Claims, whether direct or indirect, including but not limited to, impact or delay damages, arising from the subject matter of the Change Order; or attorneys' fees and costs arising from a dispute with a Subcontractor over the Change Order.

§ 7.2.9 Methods used in determining adjustments to the Contract Sum shall be those listed in Section 7.3.3.

### § 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 and/or Change Proposal Request shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more ways listed below. The first method listed shall be used unless the Architect determines that the method is inappropriate, in which case another method shall be selected:

- .1 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation. Contractor shall provide on company letterhead backup documentation and submit proposal cost and/or by either using unit costs method with attached supporting data or by using labor, materials and equipment method with attached supporting data. One form shall be utilized by each trade involved in the change in the work with an overall summary form by the Contractor for the entire change. Where additional Work is involved, the lump sum shall represent the estimated cost of labor and materials; plus markups to cover miscellaneous fees and profit if not funded by an allowance:

To compensate the Contractor or Subcontractor actually performing a part of the Work for the combined cost of miscellaneous fees and profit, the performing party shall be entitled to a single markup not to exceed 15% of the estimated cost of that part of the Work.

To compensate the Contractor for the combined cost of miscellaneous fees and profit on work performed by Subcontractors, the Contractor shall be entitled to a single markup not to exceed 10% of the subcontract amount if not funded from an allowance. (Contractor shall not be allowed a markup for miscellaneous fees and profit if change is funded by an allowance.)

When a Sub-subcontractor performs the Work of a change, the 15% markup for combined miscellaneous fees and profit shall be used only by the Sub-subcontractor. The Subcontractor and Contractor would each be entitled to a single markup not to exceed 10% of the cost to them from the Subcontractor and sub-subcontractor respectively if not funded by an allowance. (Contractor shall not be allowed a markup for miscellaneous fees and profit if change is funded by an allowance.)

- .2 By unit prices stated in the Contract Documents or subsequently agreed upon; Additional markups for miscellaneous fees, and profit will not be allowed in Unit Price Work;
- .3 By 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 Subsection 7.3.6.
- .5 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 itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above on company letterhead. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.
- .6 For changes in the work the Contractor, Owner and Architect agree to be bound by the below stated required time lines.

Upon issuance of a Change document, Contractors, Subcontractors and Sub-subcontractors shall provide the proposed pricing on company letterhead with the required supporting back up

documentation no later than fifteen (15) business days after receipt of the proposed change document. Architect and Owner shall review Contractor's pricing and within ten (10) business days accept pricing as submitted by the Contractor or reject the pricing and return to the Contractor with specific reasons for rejections. If pricing is rejected, Contractor shall review the specific rejections and modify pricing to address the specific rejection and resubmit to the Architect and Owner comments within two (2) business days after receipt of rejection comments. The Architect and Owner shall review the revised pricing and either accept the revised pricing, or if pricing is still in dispute, the Architect shall issue a Construction Change Directive.

#### **§ 7.3.4**

*(Paragraphs deleted)*

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.

**§ 7.3.5** 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.

**§ 7.3.6** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect or Owner shall determine the method and 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 miscellaneous fees, overhead and profit except if funded by Allowance. 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 7.3.7 shall be limited to the following:

- .1 costs of labor, including social security, retirement and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .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, and;
- .4 additional costs of supervision and field office personnel directly attributable to the change.

**§ 7.3.7** 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 miscellaneous fees and profit shall be figured on the basis of net increase or decrease, if any, with respect to that change.

**§ 7.3.8** Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment accompanied by an approved Change Order or Change Proposal Request indicating the parties' agreement with part or all of such costs. For any portion of such costs that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs. The 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 4.

**§ 7.3.9** 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 shall be recorded by preparation and execution of an appropriate Change Order.

*(Paragraph deleted)*

#### **§ 7.4 Minor Changes in the Work**

**§ 7.4.1** The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents with Owner's written approval. Such changes will be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly with Owner's written approval.

## **§ 7.5 Changes Funded by Allowances**

**§ 7.5.1** Allowance balances may be used to fund changes in the work. The Contractor will not be allowed a mark-up for overhead and profit when changes in the work are funded by one of the Allowances. Cost for changes funded by allowances shall be determined by methods described in Article 7.3.3. Miscellaneous fees and profit mark-up shall be allowed on work performed by Subcontractors, Sub-subcontractors and the Contractor's own forces, in accordance with Section 7.2 and 7.3.

**§ 7.5.2** Changes funded by Allowances shall require back-up documentation per Section 7.3.3.

## **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** Unless agreed otherwise, the date inserted on the Agreement form and the Date of Commencement constitute "0" (zero) of the stated Completion Time.

**§ 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. The term "regular working day" as used in the Contract Documents shall mean any day from Monday through Friday, exclusive of those holidays normally recognized in the construction industry and/or approved by District-approved calendar.

### **§ 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, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner, and approved by the Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by the Contract Documents or a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five (5) days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

**§ 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 fire, or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect and Owner determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect and Owner may determine.

**§ 8.3.2** Claims relating to time shall be made in accordance with applicable provisions of Article 4.

**§ 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** Extensions of time granted for causes described herein will be granted on the basis of one Regular Working Day extension for each Regular Working Day lost (i.e. seven (7) Calendar Days extension will be granted after five (5) Regular Work Days are lost except as modified by the provisions contained herein related to Anticipated Weather days).

§ 8.3.5 Each Proposer shall include in his proposed construction schedule an allowance of regular work days per year as defined in 1.7.7.4, in which work is delayed for student testing or other unspecified campus events. In addition, each proposer shall include an allowance of Anticipated Weather Days in accordance with following:

Number of anticipated Weather Days (These are regular working days)

January	5	July	8
February	5	August	8
March	5	September	7
April	4	October	4
May	7	November	6
June	7	December	5

§ 8.3.6 Weather Days shall pertain to such items as rain, flooding, snow, unusually high winds, excessively wet grounds, or the like which prevent progress on major portions of the work on regular working days only. If such situations occur on more than the number of Anticipated Weather Days indicated above and if those additional days prevent the Contractor from performing critical portions of the scheduled work, extensions of time cause by inclement weather may be requested as enumerated hereinafter: if the inclement weather is rain related, the rain at the site must have been in excess of 0.5 inch in 24 hours.

§ 8.3.7 At the beginning of each month the Contractor shall submit a status report for the preceding month, showing 1) the scheduled number of Anticipated Weather Days for the particular month, 2) the actual Weather Days requested, and 3) the Net Weather Days (plus, minus, or no change). At times deemed appropriate by the Architect or when requested in writing by the Contractor, the Contract time will be adjusted by Change Order if the total of Net Weather Days is substantially greater than "0". Unused Anticipated Weather Days may be accumulated during the Contract Time and may be used to offset Actual Weather days in other months. If the Contractor fails to submit said monthly status report, it will be assumed that none of the Anticipated Weather Days were used for that month and that they shall accumulate for possible future offset against Net Weather Days; however, if at the end of the project all Anticipated Weather days have not been used, the contract completion time will not be reduced. An example of the monthly schedule to be submitted is as follows:

Month	Anticipated Weather Days (Regular)	Actual Weather Days (Regular) Requested	Net Weather Days (Regular)
January	5	11	6
February	5	0	-5
March	5	2	-3
April	4	2	-2
May	7	12	5
June	7	11	4
Totals	33	38	5

Using this example (and assuming that all requested days were approved) there were 5 Net Weather Days (regular) for the six (6) months of the project and the extension of Contract Time would be seven (7) Calendar Days).

§ 8.3.8 Extensions of the Contract Time will only be considered after the number of anticipated delay days has been expended through mutual agreement by the Owner, Architect and Contractor.

§ 8.3.9 The following is a requirement of the Contract and will be included in the Agreement Between Owner and Contractor under Time of Completion and the blank spaces will be completed indicating the completion date as stated on the Proposal Form.



**§ 8.3.10** The Work to be performed under this Contract shall be commenced in accordance with Section 8.1.2 and the following Substantial Completion Date(s) must be achieved. Refer to the Project Manual for description of Phasing, if any.

1. Refer to Document A101-2017 Standard Form of Agreement Between Owner and Contractor as amended, Article 3.3 for required substantial completion date(s).

The parties hereto agree that time is of the essence of this Contract and that the pecuniary damages which would be suffered by the Owner, if the Contractor does not achieve the phased construction completion called for in the Contract Documents by the specified dates, are in their very nature difficult to ascertain. Refer to Section 8.4 for Liquidated Damages.

#### **§ 8.4 Liquidated Damages**

**§ 8.4.1** The parties hereto agree that time is of the essence of this Contract and that the pecuniary damages which would be suffered by the Owner, if the Contractor does not achieve the phased construction completion called for in the Contract Documents by the specified dates, are in their very nature difficult of ascertainment. The sums per Calendar Day to be paid in consideration of all actual costs such as rental costs, additional supplies, labor, overtime, and especially disruption of the educational programs and lost administrative time, which cannot be readily determined are as follows:

Elementary Schools (New Construction and/or Renovations):	\$1,000.00/Calendar Day
Middle Schools (New Construction and/or Renovations):	\$2,000.00/Calendar Day
High Schools (New Construction and/or Renovations):	\$3,000.00/Calendar Day
Athletic Fields (New Construction and/or Renovations):	\$1,000.00/Calendar Day
Miscellaneous Facilities (New Construction and/or Renovations):	\$1,000.00/Calendar Day

**§ 8.4.1.1** 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 an equitable sum per Calendar Day for each and every Calendar Day beyond the specified date of Substantial Completion, which the Contractor shall require for Substantial Completion of the Work included in this Contract. 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 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 damages being caused by additional compensation to personnel, for loss of interest on money, and other increased costs, all of which are by their nature difficult of exact ascertainment.

**§ 8.4.1.2** If the Contractor fails to complete all requirements of Final Completion within ninety (90) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the job site or Owner's office until such time as the close-out documents and all punch list items are completed and accepted by Owner. During this time the General Contractor will be charged for the Owner's, Architect's, and any consultant's time. Billable time will include without limitation travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions. These weekly meetings shall include a minimum two (2) hour charge per participant. Costs will be deducted from Contractor's Final Payment. Hourly rates shall be as follows:

#### **Consultants:**

- Principal Architect/Engineer/Consultant: \$175.00
- Project Architect/Engineer/Consultant \$150.00
- Staff Architect/Engineer/Consultant \$120.00
- Field Representative/Architect/Engineer/Consultant \$100.00
- Secretarial \$ 50.00

#### **Project Owner:**

Init.

• Associate Superintendent	\$225.00
• Assistant Superintendent	\$200.00
• Director	\$175.00
• Senior Project Manager	\$165.00
• Project Manager	\$150.00
• Project Coordinator	\$120.00
• Secretarial	\$ 50.00
• Maintenance Technician	\$ 50.00
• Operations Personnel	\$ 33.00

## 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.

*(Paragraph deleted)*

### § 9.2 Schedule of Values

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect and Owner may require. This schedule, unless objected to by the Architect or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.2.2 In order to facilitate the review of Applications for Payment, the Schedule of Values shall be submitted on AIA Documents G702 and G703 or other similar forms approved by the Owner, and shall include the following:

- .1 General Contractor's costs for Contractor's fee, bonds and insurance, mobilization, project close-out etc., shall be listed as individual line items.
- .2 Contractor's costs 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.
- .3 On major subcontracts, such as mechanical, electrical, plumbing, and low voltage, the schedule shall indicate line items and amounts in detail (e.g. underground, major equipment, fixtures, installation of fixtures, start up, close-out, etc.)
- .4 Costs for subcontract Work shall be listed without any addition of General Contractor's costs for miscellaneous fees, profit or supervision.
- .5 Where payment for stored materials may be requested prior to installation, material and labor shall be listed as separate line items. Stored materials will only be paid for the amount of actual invoices of same materials.
- .6 Sample pages from an approved schedule of values are included in Section 01 29 73 of the project specifications.
- .7 Where work occurs at more than one building, for the Owner's accounting purposes and to facilitate the checking and verification of the Contractor's Application for Payment, cost shall be scheduled separately for each building on the G703 Continuation Sheets. Building additions and renovations shall be listed separately.
- .8 All work outside the building envelope excluding overhangs and canopies shall be listed separately under Site work.

### § 9.3 Applications for Payment

§ 9.3.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values.

Init.

Prior to this submittal, the Contractor shall contact the Architect's Field Department and Owner for on-site review of the proposed application. On-site reviews shall include review of all lien releases and stored materials. See project manual for additional requirements. Upon approval by the Architect's Field Department and Owner, the Application for Payment shall be notarized and submitted to the Architect. Included shall be data required to support lien releases, Application for Payment Checklist (Section CA), invoices and/or receipts. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for in the Contract Documents.

**§ 9.3.1.1** As provided in Section 7.3.8, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Change Proposal Requests, 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 and 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 off-site storage area.
- .5 All items shall be marked and clearly tagged as property of the Owner.

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. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment. Contractor shall only be paid for the amount of the actual invoices submitted as backup for stored materials.

The Contractor acknowledges that the review of materials stored off site is an additional service of the Architect and shall be charged for that service. The cost for that 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, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

**§ 9.3.4** Contractor's progress payment draws for fees and general conditions (including miscellaneous fees and profit) shall not exceed the percentage completion of the Work in place for the entire Project as indicated on the Application for Payment.

**§ 9.3.4.1** By signing each Application for Payment, Contractor stipulates and certifies the following: that the information presented is true, accurate, and complete; that the Contractor has made the necessary detailed examinations, audits, and arithmetic verifications that the submitted Work has been completed to the extent represented in the Application for Payment, that the materials and supplies identified in the Application for Payment have been purchased, paid for, and received; that the subcontractors have been paid as identified in the Application for Payment or that the Contractor has been invoiced for same; that he has made the necessary on-site inspections to confirm the accuracy of the Application for Payment; that there are no known mechanics' or materialmen's liens outstanding at the date of this requisition; that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current application; that except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmen's liens on the Work; that the Payment Application includes only Work self-performed by Contractor of for which Contractor has been invoiced; and that releases from all subcontractors and materialmen have been obtained in such a form as to constitute an effective release of lien under the laws of the State of Texas covering all Work performed and for which payment has been made by the Owner to the Contractor.

**§ 9.3.5** Contractors shall submit digitally one (1) application using AIA Document G702 and G703, Application and

Certificate for Payment, 1992 Edition. All blanks in the form must be completed and signatures of Contractor and Notary Public must be original on each form.

**§ 9.3.6** Contractor shall submit Application to the Architect in sufficient time (no later than Thursday at noon) to ensure that the Architect submits Application to the Owner on the first Monday of the Month (or previous business day if Monday is a Holiday as defined in this Agreement), prior to 12:00 pm. Applications will not be accepted on any other day of the week.

#### **§ 9.4 Certificates for Payment**

**§ 9.4.1** The Architect will, within seven (7) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part 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 comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. 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. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. 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 material 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.

**§ 9.4.3** The Architect will affix his signature to the same form described in Paragraph 9.3.4 to signify his certification of payment provided the application is otherwise satisfactory.

**§ 9.4.4** The issuance of a Certificate for Payment shall constitute a recommendation to the Owner regarding the amount to be paid, this recommendation is not binding on the Owner if the Owner knows of other reasons under the Contract Documents why payment should be withheld.

#### **§ 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 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 persistent failure to carry out the Work in accordance with the Contract Documents.

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

*(Paragraphs deleted)*

**§ 9.6 Progress Payments**

§ 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.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven (7) 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. 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 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Payments to material and equipment 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 and 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, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

*(Paragraph deleted)*

§ 9.6.8 Based upon Applications for Payment and supporting documents including monthly updates of record drawings 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 in the conditions of the Contract as follows:

95% of the proportion of the Contract Sum properly allocable to labor, materials and equipment incorporated in the Work and 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 by the parties; less the aggregate of previous payments in each case; and upon Substantial Completion of the entire work, a sum sufficient to increase the total payments to 95% of the Contract Sum less such retainages as the Architect shall determine for all incomplete work and unsettled claims.

Owner reserves the right to require that conditional Lien Releases be submitted by the Contractor and all subcontractors, sub-subcontractors and major suppliers with each Application for Payment after the first Application for Payment for which payment was made by the Owner for the certified amount for all previous applications for payments. Owner may withhold payment on-line items for which a lien or claim (or similar notice of intent) has been filed, until satisfactory release has been received by Owner.

Contractor shall not withhold as retainage a greater percentage for the Subcontractors or materialmen than the percentage that Owner withheld as retainage from payments to the Contractor.

## **§ 9.7 Failure of Payment**

If the Architect does not issue a Certificate for Payment or notify Contractor of rejection, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract Documents the amount certified by the Architect, then the Contractor may, upon seven (7) additional days' written 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 shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

**§ 9.7.1** If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, then such payment shall be made promptly upon demand by the Owner. Any payments that are past due more than thirty (30) days after the Owner's invoice date may result in owner's rejection of Application for Payment.

## **§ 9.8 Substantial Completion**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work is sufficiently complete for the Owner to occupy, operate, and maintain the Work. Owner and Architect shall make the final determination as to which provisions of the Contract Documents are necessary to meet this criteria, whether or not such requirements are specifically enumerated in this Section or in other portions of the Contract Documents as being specifically required for Substantial Completion.

**§ 9.8.1.1** The following items are a partial list of requirements, as applicable to the Project, that must be completed prior to the established Substantial Completion. This is not intended to be an exhaustive list, but a guideline:

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. All inspections by government authorities having jurisdiction over the project must have been finalized, any remedial work required by them must have been completed, and Certificates of Occupancy, local fire marshal and health department approval certificates and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
3. All exterior clean-up and landscaping must be complete, including required stand of grass mowed, edged, weeded, and fertilized.
4. All interior shall have been completed and cleaned except minor items which, if complete after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. Contractor shall provide list of these specific items, which include punch list and completion items. 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 shall be the sole judge of what constitutes a significantly large number of items.
5. All third-party HVAC air and water balancing must be complete.
6. All energy management systems must be complete, fully operational and demonstrated to the Owner, with graphics transferred to the main server.
7. All emergency/standby generator and low voltage lighting control systems must be complete, fully operational and demonstrated to the Owner.
8. All security systems must be complete, fully operational and demonstrated to the Owner, and must be monitorable from the District's central Police/Security Center.
9. All school communications equipment, telephone systems and P.A. systems must be complete and demonstrated to the Owner.
10. All final lockset cores must be installed and all final Owner directed keying completed.
11. All room plaques and exterior signage must be complete.
12. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment and all life safety systems.
13. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
14. All operation and maintenance manuals are delivered and approved by Architect and Owner ("D-slant" ring binders in duplicate).
15. Health Department Inspections and Municipal Utility District (MUD) and Drainage District and County approvals must be provided.
16. All other reports, testing results, certifications, studies, etc. required by 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.

**§ 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, operate, and maintain 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, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall 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 such Certificate.

### **§ 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 as required under Article 11 and authorized by public authorities having jurisdiction over the Work. 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 written notice that the Work is ready for final inspection and acceptance, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, and the Owner agrees that all closeout requirements have been fulfilled, 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 terms and conditions of 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 and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor

knows of no substantial 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 and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, 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.

**§ 9.10.3** Prior to final payment, the Contractor shall submit in triplicate (one (1) original and two (2) copies) to the Architect the following completed forms:

1. Contractor's Affidavit of Payment of Debts and Claims, AIA Document G706.
2. Contractor's Affidavit of Release of Liens, AIA Document G706A
3. Consent of Surety to Final Payment, AIA Document G707.
4. General Contractor's Guarantee - notarized
5. Subcontractor's Warranties from each Subcontractor on Final Subcontractor List
6. All Subcontractors and suppliers and also any other parties that had submitted claims of non-payment shall submit Conditional Lien Releases – notarized. Executed document shall be dated within thirty (30) days of submission of final pay application.
7. Each Offeror (and Subcontractor and supplier submitting a proposal to an Offeror) shall submit a notarized affidavit stating that no asbestos, PCB or lead containing building materials were used on Owner's form.
8. Maintenance, inspection and warranty manuals. Two (2) sets of each bound in a 3-inch "D-slant" ring binder.
9. Record drawings. See Section 3.20.
10. Final Subcontractor List.
11. Refer to Specification Section 01 77 00, Guarantees, Certificates and Project Closeout for any additional information and requirements.
12. Executed TEA Project Compliance Certificate Form (Form 'AL').
13. Executed project Close-Out Form (Form 'AO'), and any additional provisions stated on Form 'AO' as being the responsibility of Contractor.

Documents identified as affidavit must be notarized. All documents requiring signatures must have original signatures (no stamps), and must indicate printed name of signer. All manuals will contain an index listing the information submitted. The index sections will be divided and identified by tabbing each section as listed in the index.

All Manufacturers' warranties must be on manufacturer's original form, indicating project name, and length of warranty.

The Owner may accept certain portions of the work as being complete prior to the acceptance of the entire project. If certain areas are accepted by the Owner as being complete, and if the Contractor has completed all of the requirements for final payment of that portion of work, the Owner may release retainage for that area/portion of work. Amounts of retainage shall be agreed upon by both Owner and Contractor prior to final acceptance of these areas.

Refer to Project Manual for additional requirements.

#### **§ 9.10.4**

*(Paragraphs deleted)*

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 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 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.

**§ 9.10.5** 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; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.6 Acceptance of final payment by the Contractor, a Subcontractor or material 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.

## 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.

§ 10.1.1 Contractor's employees, agents, and Subcontractors and Sub-subcontractors shall not perform any service under this Contract while under the influence of alcohol or any controlled substance. Contractor, its employees, agents, and Subcontractors shall not use, possess, distribute, or sell illicit or unprescribed controlled drugs or drug paraphernalia, or misuse legitimate prescription drugs while performing the Work. Contractor, its employees, agents, and Subcontractors shall not use, possess, distribute, or sell alcoholic beverages while performing the Work.

§ 10.1.2 Contractor has adopted or will adopt its own policy to assure a drug and alcohol-free workplace while performing the Work. Contractor will remove any of its employees from performing the Work any time there is suspicion of alcohol and/or drug use, possession, or impairment involving such employee, and at any time an incident occurs where drug or alcohol use could have been a contributing factor. Owner has the right to require Contractor to remove employees from performing the Work any time cause exists to suspect alcohol or drug use. In such cases, Contractor's employees may only be considered for return to work after the Contractor certifies as a result of a for-cause test, conducted immediately following removal that said employee was in compliance with this Contract. Contractor will not use an employee to perform the Work who either refuses to take, or tests positive in any alcohol or drug test.

§ 10.1.3 Contractor will comply with all applicable federal, state, and local drug and alcohol related laws and regulations (e.g., Department of Transportation regulations, Department of Defense Drug-free Work-free Workforce Policy, Drug-Free Workplace Act of 1988). Owner has also banned the presence of all weapons on the Project Site, whether or not the owner thereof has a permit for a concealed weapon.

### § 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 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 owners and users of adjacent sites and utilities.

§ 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. When use or storage of explosives or other Hazardous Substances (as hereinafter defined) or equipment or unusual construction methods are necessary, the Contractor shall give the Owner reasonable advance notice of the presence or use of such materials, equipment, or methods. Contractor shall be

responsible for any Hazardous Substances Contractor or Contractor's employees, contractors, consultants, subcontractors, sub-subcontractors, materialmen, and suppliers use, store, or otherwise introduce to the Premises.

**§ 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, except damage or loss 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.

*(Paragraphs deleted)*

**§ 10.2.8** The Contractor shall be responsible for taking all precautions necessary to protect the work in place from any weather conditions including without limitations to flooding, freezing, high winds, tropical storms, hurricanes, etc. 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 such weather conditions.

### **§ 10.3 Hazardous Materials**

**§ 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, including but not limited to asbestos or polychlorinated biphenyl (PCB), 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.

**§ 10.3.2** If requested in writing by the Contractor, 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 verify that it has been rendered harmless. If requested in writing by the Contractor or Architect, 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 such material or substance or who are to perform the task of removal or safe containment of such 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.

*(Paragraphs deleted)*

**§ 10.4** The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents.

### **§ 10.5 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 Section 4.3.7.

### **§ 10.6 Asbestos, Lead or PCBs Containing Materials**

**§ 10.6.1** The contractor and each subcontractor, **sub-subcontractor and suppliers** prior to final payment, shall submit an original notarized statement on their letterhead certifying "to the best of their information, knowledge, and belief asbestos-, lead-, and PCB-containing materials, and have not been used or incorporated into the Work and lead or lead-bearing materials have not been incorporated into potable water systems." For the purpose of definition as used in

this statement, the term "potable water systems" includes, but is not limited to, those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibs, as applicable to the project.

**§ 10.6.2** To the best knowledge of the Owner, the Architect and his consultants, no products or materials containing asbestos or polychlorinated biphenyl (PCB) or other toxic substances have been specified for this project. No products or materials containing asbestos or PCB are to be incorporated in this project. In the event the Contractor or his Sub-contractors become aware that any products or materials specified, ordered, scheduled for or already incorporated in the work on this project, contain asbestos, or PCB, the situation shall be reported immediately to the Owner and Architect in writing. An acceptable, equal substitute for the product or material in question shall be proposed by the Contractor and the product or material in question, if already onsite or incorporated in the work, shall be removed from the site immediately and returned to the supplier or manufacturer.

## **ARTICLE 11 INSURANCE AND BONDS**

### **§ 11.1 Contractor's Liability Insurance**

*(Paragraph deleted)*

**§ 11.1.1** Refer to Section BD - Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management. The Contractor and Contractor's Subcontractors shall purchase and maintain, in a company or companies licensed and admitted by the Texas Department of Insurance to engage in the business of furnishing insurance in the State of Texas, the types and amounts of insurance as set forth in Section BD of the Agreement to protect it and the Owner from claims that may arise out of, or result from, the Contractor's operations under the Contract, whether such operations be by itself, or by any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. All insurance companies shall have an "A-VIII" in Best's Rating Guide and shall be satisfactory to the Owner. No Work will be commenced until all requirements of this Article have been approved by the Owner in writing.

**§ 11.1.2** The insurance required by Section BD - Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until dates specified in Section BD.

**§ 11.1.3** Original Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These certificates and the insurance policies required by this Section BD – Insurance and Bonds Requirements for Contractors and Facility Renters Cypress-Fairbanks Independent School District Insurance Management shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the Final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

*(Paragraphs deleted)*

### **§ 11.2 Owner's Liability Insurance**

**§ 11.2.1** The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

*(Paragraphs deleted)*

### **§ 11.3 Project Management Protective Liability Insurance**

**§ 11.3.1** Optionally, the Owner may require the Contractor to purchase and maintain Project Management Protective Liability insurance from the Contractor's usual sources as primary coverage for the Owner's, Contractor's and Architect's vicarious liability for construction operations under the Contract. Unless otherwise required by the Contract Documents, the Owner shall reimburse the Contractor by increasing the Contract Sum to pay the cost of purchasing and maintaining such optional insurance coverage, and the Contractor shall not be responsible for purchasing any other liability insurance on behalf of the Owner. The minimum limits of liability purchased with such coverage shall be equal to the aggregate of the limits required for Contractor's Liability Insurance under Section 11.1.

*(Paragraphs deleted)*

**§ 11.3.2** To the extent damages are covered by Project Management Protective Liability insurance, the Owner, Contractor and Architect waive all rights against each other for damages, except such rights as they may have to the proceeds of such insurance. The policy shall provide for such waivers of subrogation by endorsement or otherwise.

#### **§ 11.4 Performance Bond and Payment Bond**

**§ 11.4.1** The Owner requires the Contractor to furnish payment and performance bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract in a total amount equal to 100% of the Contract Sum and in conformity with applicable law. All bonds shall be issued by a surety company licensed, listed, and authorized to issue bonds in the State of Texas by the Texas Department of Insurance. The surety company may be required by the Owner to have a rating of not less than "B" in the latest edition of Best's Insurance Reports, Property-Casualty. The surety company shall provide, if requested, information on bonding capacity, other projects under coverage and shall provide proof to establish adequate financial capacity for the Project. Should the bond amount be in excess of ten percent (10%) of the surety company's capital and surplus, the surety company issuing the bond shall certify that the surety company has acquired reinsurance, in a form and amount acceptable to the Owner, to reinsure the portion of the risk that exceeds ten percent (10%) of the surety company's capital and surplus with one or more reinsurers who are duly authorized and admitted to do business in Texas and that amount reinsured by a reinsurer does not exceed ten percent (10%) of the reinsurers capital and surplus.

**§ 11.4.2** 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 permit a copy to be made.

**§ 11.4.3** The Contractor shall deliver the required Bonds to the Owner not later than the date of the preconstruction meeting if the Contract has been executed by Owner. All Bonds will be reviewed and approved by the Owner for compliance with the Contract Documents prior to the Contractor mobilizing onsite. Upon Owner approval, the Contractor will be allowed to mobilize onsite.

**§ 11.4.4** All bonds shall be originals. The Contractor shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney. The name, address, and telephone number of a contact person for the Bonding Company shall be provided.

**§ 11.4.5** Bonds shall guarantee the faithful performance of all the covenants, stipulations, and agreements of the Contract. Bonds shall be signed by an agent resident in the State of Texas and date of bond shall be the date of execution of the Contract. If at any time during the continuance of the Contract, the surety of the Contractor's bonds becomes insufficient, the Owner shall have the right to require additional and sufficient sureties which the Contractor shall furnish to the satisfaction of the Owner within ten (10) days after notice to do so. In default thereof, all payment or money due to the Contractor may be withheld until Contractor provides additional surety.

**§ 11.4.6** It is distinctly understood that no mechanic, contractor, Contractor, materialman, vendor, artisan or laborer, skilled or unskilled, shall have, claim or acquire any lien upon the Project or any of the improvements in the Project, nor upon any of the land upon which the Project is located.

### **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, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

## **§ 12.2 Correction of Work**

### **§ 12.2.1 Before or After Substantial Completion**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after 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.

### **§ 12.2.2 After Substantial Completion**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one (1) 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 an 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 written 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 2.4.

**§ 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.

*(Paragraph deleted)*

**§ 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, whether completed or partially completed, of the Owner or separate contractors 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.

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 Governing Law**

**§ 13.1.1** The Contract shall be governed by Texas law and mandatory and exclusive venue for any disputes shall be in Harris County, Texas.

### **§ 13.2 Successors and Assigns**

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such

an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

*(Paragraph deleted)*

### **§ 13.3 Written Notice**

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

*(Paragraphs deleted)*

### **§ 13.4 Rights and Remedies**

**§ 13.4.1** 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.

**§ 13.4.2** 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 there under, except as may be specifically agreed in writing.

*(Paragraphs deleted)*

### **§ 13.5 Tests and Inspections**

**§ 13.5.1** Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. 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 which do not become requirements until after bids are received or negotiations concluded.

**§ 13.5.2** 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 13.5.1, 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 13.5.3, shall be at the Owner's expense.

**§ 13.5.3** If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 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, their Consultants, or Owner's Third Party Consultant services, and expenses shall be at the Contractor's expense.

**§ 13.5.4** 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.

**§ 13.5.5** 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.

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

### **§ 13.6 Commencement of Statutory Limitation Period**

**§ 13.6.1** As between the Owner and Contractor:

- .1** Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged

- cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- .2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
  - .3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any Warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

**§ 13.7** Refer to Specification Sections 01 35 23, 01 35 23.1 and 01 35 23.2 - Special Owner Requirements for additional requirements to be included as part of the Contract.

**§ 13.8** The Owner shall have the right to examine, copy and/or audit the books and other records in possession of the Contractor relating to this Contract at any time deemed necessary by the Owner.

## **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 sixty (60) consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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 promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

**§ 14.1.2** The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work properly executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable miscellaneous fees, profit, and damages.

**§ 14.1.4** If the Work is stopped for a period of sixty (60) consecutive Calendar Days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor 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 (7) additional days' written 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**

*(Paragraphs deleted)*

**§ 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 for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards laws, ordinances, or rules and regulations, or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.
- .5 fails to furnish the Owner, upon written request, with assurances satisfactory to the Owner, evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents;
- .6 engages in serious or repeated worker misconduct in violation of Article 3.3.2;
- .7 engages in conduct that would constitute a violation of state or federal criminal law, including but not limited to, the laws prohibiting certain gifts to public servants, or engages in conduct that would constitute a violation of the Owner's ethics or conflict of interest policies; or
- .8 fails to proceed continuously and diligently with the construction and completion of the Work, except as permitted under the Contract Documents.

**§ 14.2.2** When any of the above reasons exist, 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 (7) days' written 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 the site and 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.

*(Paragraph deleted)*

**§ 14.2.3** The parties hereby agree that: 1) if an order for relief is entered on behalf of the Contractor, pursuant to Chapter 11 of the U.S. Bankruptcy Code; 2) if any other similar order is entered under any debtor relief laws; 3) if Contractor makes assignments for the benefit of one or more of its creditors; 4) if a receiver is appointed for the benefit of its creditors; or 5) if a receiver is appointed on account of its insolvency, any such event could impair or frustrate Contractor's performance of the Contract Documents. Accordingly, it is agreed that upon occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest, adequate assurance of future performance in accordance with the terms and conditions of the Contract Documents. Failure to comply with such request within ten (10) days of delivery of the request shall entitle Owner to terminate the Contract and to the accompanying rights set forth in Subparagraphs 14.2.1 through 14.2.6. In all events, pending receipt of adequate assurance of performance and actual performance in accordance with the Contract Documents, Owner shall be entitled to proceed with the Work with Owner's own forces or with other Contractors on a time and material or other appropriate basis, the cost of which will be charged against the Contract Sum.

**§ 14.2.4** 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.

**§ 14.2.5** 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 Architect, upon application, and this obligation for payment shall survive termination of the Contract.

**§ 14.2.6** Contractor hereby assigns the 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).

**§ 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 as described in 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 written 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 case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Section 14.1.3.

*(Paragraphs deleted)*

### ARTICLE 15 LABOR STANDARDS

*(Paragraphs deleted)*

#### § 15.1 PREVAILING WAGE RATES

*(Paragraphs deleted)*

§ 15.1.1. Contractor, Contractor's Subcontractors and Sub-subcontractors shall pay all workers not less than the general prevailing rate of per diem wages for work of a similar character where the project is located as detailed in the "Minimum Wage Schedule" in section CB of the specifications, or as otherwise provided in the Contract Document. Wages listed are minimum rates only. However, no claims for additional compensation above the Contract Sum shall be considered by the Owner because of payments of wage rates in excess of the applicable rate provided herein. Texas Government Code § 2258.001 *et seq.*

*(Paragraphs deleted)*

§ 15.1.2 Contractor shall forfeit, as a penalty to the Owner, \$60 for each laborer, worker, or mechanic, employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the Contract Documents.

*(Paragraphs deleted)*

§ 15.1.3 Owner reserves the right to receive and review payroll records, payment records, and earning statements of employees of Contractor, and of Contractor's Subcontractors and Sub-subcontractors.

*(Paragraphs deleted)*

§ 15.1.4 If no prevailing wage rate schedule is made part of the Contract Documents, then the parties shall use the wage rate determined by the U.S. Department of Labor in accordance with the Davis-Bacon Act, 40 U.S.C. § 276a.

*(Paragraphs deleted)*



**FORM BB**

**TEXAS STATUTORY PERFORMANCE BOND**  
(Penalty of this bond must be 100% of contract amount)

**Bond No.:** \_\_\_\_\_

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

\_\_\_\_\_

(hereinafter called the Obligee) in the amount of \_\_\_\_\_

\_\_\_\_\_

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this \_\_\_\_\_ day  
of \_\_\_\_\_, \_\_\_\_\_.

**2024 CY CREEK HS RENOVATION**  
**CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT**  
**CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 24-02-5754-R-RFP**

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 \_\_\_\_\_, \_\_\_\_\_.

\_\_\_\_\_  
Principal (Seal)

\_\_\_\_\_  
Surety Address

By: \_\_\_\_\_  
Signature and Printed Name

\_\_\_\_\_  
Surety Telephone Number

\_\_\_\_\_  
Surety (Seal)

By: \_\_\_\_\_  
Attorney-in-Fact: Signature and Printed Name



**FORM BC**

**TEXAS STATUTORY PAYMENT BOND**  
(Penalty of this bond must be 100% of contract amount)

**Bond No.:** \_\_\_\_\_

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

\_\_\_\_\_

(hereinafter called the Obligee) in the amount of \_\_\_\_\_

\_\_\_\_\_

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

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this \_\_\_\_\_ day  
of \_\_\_\_\_, \_\_\_\_\_.

**2024 CY CREEK HS RENOVATION  
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT  
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 24-02-5754-R-RFP**

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

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all  
claimants supplying labor and material to him or a Subcontractor in the prosecution of the work provided for in said  
contract, then this obligation shall be void; otherwise to remain in full force and effect.

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

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this \_\_\_\_\_  
day of \_\_\_\_\_, \_\_\_\_\_.

Witness: \_\_\_\_\_ (Seal)  
Principal

\_\_\_\_\_ By: \_\_\_\_\_  
Signature and Printed Name

Witness: \_\_\_\_\_ (Seal)  
Surety

\_\_\_\_\_ By: \_\_\_\_\_  
Attorney-in-Fact: Signature and Printed Name

\_\_\_\_\_

Surety Address

\_\_\_\_\_

Surety Telephone Number



## SECTION BD

### INSURANCE AND BONDS REQUIREMENTS FOR CONTRACTORS AND FACILITY RENTERS

#### CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT INSURANCE MANAGEMENT

##### 1.0 GENERAL

- A. The District shall require that the following insurance requirements be met on public works contracts:
1. No Work will be commenced until all requirements of this Section have been approved by the District in writing.
  2. The District shall be furnished a Declaration of Insurance evidencing all policies and endorsements required by this Section prior to proceeding with any work.
  3. The insurance shall contain a provision that at least thirty days prior written notice shall be given to the District in the event of cancellation, material change, or non-renewal.
  4. Insurance shall be underwritten by a company rated not less than B+ VII in Best's latest published guide.
  5. There shall be a hold harmless agreement in which the Contractor assumes liability on the contract and holds the School District harmless.
  6. The Contractor shall purchase and maintain in force the following kinds of insurance and bonds for operations under construction contracts and as specified in each section.
  7. No deletions/exclusions from standard coverage form are allowed without the written consent of Cypress-Fairbanks Independent School District.
  8. Furnish copies of subcontractors Certificates of Insurance to Owner.
  9. Furnish copies of Worker Compensation Documents to Owner.

##### 2.0 CASUALTY INSURANCE

- A. Worker's Compensation Insurance Coverage

###### Definitions:

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 services on a project, for the duration of the project.

Duration of the project - includes the time from the beginning of the work on the project until one (1) year after Substantial Completion of the project.

Persons providing services on the project ("subcontractor" in Texas Labor Code 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, or employees of any entity that furnishes persons to provide services on the project. "Services" shall 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 deliveries, and delivery of portable toilets.

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

2. The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract. The certificate shall show Cypress-Fairbanks Independent School District as the certificate holder. The policy must be endorsed to provide a “waiver of subrogation in favor of Cypress-Fairbanks Independent School District.”
3. 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 the coverage has been extended.
4. The contractor shall obtain from each person providing services on a project, and provide to the governmental entity:
  - a. a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on a project; and
  - b. no later than seven (7) 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.
5. The contractor shall retain all required certificates of coverage for the duration of the project and two (2) years thereafter.
6. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knows or should know, of any change that materially affects the provision of coverage of any person providing services on the project.
7. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers’ Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.
8. The contractor shall contractually require each person with whom it contracts to provide services on a project, to:
  - a. 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 of its employees providing services on the project, for the duration of the project. The policy must be endorsed to provide a “waiver of subrogation” in favor of Cypress-Fairbanks Independent School District;
  - b. provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project. The certificate shall show Cypress-Fairbanks Independent School District as the certificate holder;
  - c. provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - d. obtain from each other person with whom it contracts, and provide 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.
- e. retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
  - f. 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 provisions of coverage of any person providing services on the project; and
  - g. contractually require each person with whom it contracts to perform as required by paragraphs a - g, with the certificates of coverage to be provided to the person for whom they are providing services.
9. 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 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 civil actions.
10. 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.
11. The Contractor shall post the following language:

**REQUIRED WORKERS' COMPENSATION COVERAGE**

"The law requires that each person working on this site or providing services related to this construction project must be covered by workers' compensation insurance. This includes persons providing, hauling, or delivering equipment or materials, or providing labor or transportation or other service related to the project, regardless of the identity of their employer or status as an employee." Furnish copies of Workers' Compensation coverage for each person working on the project.

"Call the Texas Workers' Compensation Commission at (512) 440-3789 to receive information on the legal requirements for coverage, to verify whether your employer has provided the required coverage, or to report an employer's failure to provide coverage."

**B. Commercial General Liability Insurance (Occurrence basis only).**

Each Occurrence Limit		\$1,000,000 CSL
Products/Completed Operations	Aggregate	\$1,000,000
Personal and Advertising Injury	Occurrence	\$1,000,000
Fire Damage, Legal Liability	Any one fire	\$50,000
Medical Expenses	Any one person	\$5,000

- C. The Owner shall be named as an additional insured by endorsement on the Contractor's policy as to the subject job.

## **2.1 AUTOMOBILE LIABILITY INSURANCE**

- A. Business (Commercial) Automobile Liability Insurance  
1. Coverage for all owned, non-owned and hired vehicles:

Bodily Injury/Property Damage	\$1,000,000 CSL
-------------------------------	-----------------

## **2.2 UMBRELLA LIABILITY INSURANCE (EXCESS) \$1,000,000**

- A. The Owner shall be named as an additional insured on the Contractor's policy as to the subject job.
- B. This policy shall provide coverage over the Workmen's Compensation, Commercial General Liability and Business Automobile Liability policies.

## **2.3 PROPERTY INSURANCE (BUILDER'S RISK/INSTALLATION FLOATER)**

- A. The policy shall be written in the name of the Owner, Contractor, and subcontractors as their interest may appear.
- B. The policy shall be written on an all risk basis for physical loss or damage and include theft, vandalism, malicious mischief.
- C. The amount of coverage shall be for the full insurable value of work.
- D. The deductible shall not be over \$1,000.00 without the approval of the Owner. (Deductible losses shall be paid by the Contractor.)
- E. The policy shall include an endorsement allowing Owner occupancy, and the insurance shall not be canceled or altered on account of partial occupancy prior to completion.
- F. A subrogation clause shall waive subrogation as to the Contractor, subcontractor, sub-subcontractors, the Owner and his employees and representatives.
- G. The original builders risk policy shall be furnished to the Owner prior to start of the job and maintained through Substantial Completion

## **3.0 BONDS**

- A. Bonds are required for public works contracts under the following circumstances:
1. Performance Bond and Labor and Material Payment Bond, each in a personal sum equal to 100% of contract sum if the formal contract is in excess of \$25,000.00.
  2. A Proposal Bond or Proposal Security in the amount of 10% of any proposal of \$25,000.00 or more must be submitted with formal proposals on public works contracts or as otherwise specified in each contract.
  3. Copies of the bonds shall be filed with the county clerk and the owner shall receive a file receipt.
  4. Performance and Payment Bonds shall remain in force for one (1) year after substantial completion.
  5. The Work will not be started until the bonds and issuing companies have been accepted in writing as satisfactory by the Owner.
  6. The original bonds will be delivered to the Owner with an attached authorized power of attorney.

**END OF DOCUMENT**

**SECTION CA**  
**APPLICATION AND CERTIFICATION FOR PAYMENT**  
**CHECK LIST AND TRANSMITTAL**

Date: \_\_\_\_\_ Application for  
 Payment No.: \_\_\_\_\_  
 Architect's  
 Project: 2024 Cy Creek HS Renovation Proposal Number: 23-148.00  
 VLK  
 Owner: Cypress-Fairbanks Independent School District Architect: Architects  
 Contractor: \_\_\_\_\_

Transmitted herewith is one (1) completed copy of the above referenced Application and Certificate for Payment. By initialing each item listed below, the undersigned certifies that he/she has personally checked and determined that each of the items is in compliance with the requirements of the Contract Documents.

Item	Description	CONTRACTOR Initial to Acknowledge Compliance	ARCHITECT Initial to Acknowledge Compliance	OWNER Initial to Acknowledge Compliance	Notes, Exceptions
A	One (1) complete copy of the above Referenced Application and Certificate for Payment, signed and Notarized, are enclosed.				
B	The grand totals of the Continuation Sheet match the amounts shown on the Application and Certificate for Payment.				
C	Percentage drawn for Supervision and General Conditions is less than or equal to the Continuation Sheet grand total percentage complete.				
D	Unconditional Release for each lien or claim that is applicable to period covered in Previously Approved Pay Application. Release must identify exact amount and period as stated in the Application for Payment.				
E	Conditional Release for each lien or claim that is applicable to period covered in Current Pay Application. Release must identify exact amount and period as stated in the Application for Payment.				
F	One (1) copy of Stored Materials Inventory List and Invoices enclosed for each line item of stored materials.				
G	One (1) updated Construction Schedule enclosed.				
H	Recovery Plan from GC if project is behind schedule.				
I	Anticipated Weather Delay Log				
J	Construction Progress Photographs enclosed.				
K	Back charges are paid to date (e.g. Operations (Custodial)/Maintenance overtime, badges and retesting.)				

Submitted by (Signature): \_\_\_\_\_  
 Name (Printed or Typed): \_\_\_\_\_  
 Title: \_\_\_\_\_

Date: \_\_\_\_\_

**SECTION CB**

**SUPPLEMENTARY CONDITIONS TO THE  
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AS AMENDED**

Add the following Subparagraph:

**1.1.11 DESCRIPTION OF PARTIES**

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

1. Owner: Cypress-Fairbanks Independent School District  
Facilities & Construction Department  
11430-B Perry Road  
Houston, Texas 77064  
Phone: (281) 897-4057  
Representative: Jesse Clayburn, Asst. Superintendent of Facilities & Construction
2. Architect: VLK Architects, Inc.  
20445 SH 249, Suite 350  
Houston, Texas 77070
3. MEP Engineer: Salas O'Brien  
738 Highway 6 South, Ste. 615  
Houston, Texas 77079  
Phone: (281) 945-8888
4. Structural Engineer: Dunaway  
3200 Wilcrest Dr., Ste 4400  
Houston, Texas 77074  
Phone: (512) 306-5825
5. Civil Engineer: Brooks & Sparks  
21020 Park Row Dr.  
Katy, Texas 77449  
Phone: (281) 578-9595
6. Food Service FDP, LLC  
25317 Interstate 45  
Houston, Texas 77380  
(281) 734-5404

## **2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER**

Add the following Subparagraph:

- 2.2.6** The Contractor will be furnished, free of charge, **ten (10)** sets of drawings, specifications, and addenda, for pickup by the Contractor from the office of the Architect.

## **15.1 PREVAILING WAGE RATES**

- 15.1.3** Prevailing Wage Rate Determination Information follows on the *next page*.

## **15.1 PREVAILING WAGE RATES**

## **Prevailing Wage Rate Determination Information**

*The following information is from Chapter 2258 Texas Government Code:*

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

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

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

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

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

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

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





## Prevailing Wage Rates – School Construction Trades

June 1, 2022

Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	\$21.13
BRICKLAYER; MASON	\$25.32
CARPENTER; CASEWORKER	\$23.38
CARPET LAYER; FLOOR INSTALLER	\$25.12
CONCRETE FINISHER	\$23.40
DATA COMM/TELE COMM	\$23.50
DRYWALL INSTALLER; CEILING INSTALLER	\$26.65
ELECTRICIAN	\$25.93
ELEVATOR MECHANIC	\$28.80
FIREPROOFING INSTALLER	\$22.25
GLAZIER	\$22.30
HEAVY EQUIPMENT OPERATOR	\$22.40
INSULATOR	\$20.50
IRONWORKER	\$25.50
LABORER, HELPER	\$16.71
LATHERER; PLASTERER	\$23.25
LIGHT EQUIPMENT OPERATOR	\$20.50
METAL BUILDING ASSEMBLER	\$21.10
MILLWRIGHT	\$33.63
PAINTER; WALL COVERING INSTALLER	\$19.60
PIPEFITTER	\$26.97
PLUMBER	\$26.71
ROOFER	\$20.50
SHEET METAL WORKER	\$19.90
SPRINKLER FITTER	\$26.13
STEEL ERECTOR	\$23.25
TERRAZZO WORKER	\$23.50
TILE SETTER	\$19.58
WATERPROOFER; CAULKER	\$19.88

**Prevailing Wage Rates**  
**Worker Classification Definition Sheet**

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

END OF DOCUMENT

## **Section CC**

### **Right of Audit - Examination of Records**

1. Records for all contracts, specifically including but not limited to lump sum contracts (i.e. fixed price or stipulated sum contracts), unit price, cost plus or time & material contracts with or without a guaranteed maximum (or not-to-exceed amounts) shall upon reasonable notice be open to inspection and subject to audit, scanning, and/or reproduction during normal business working hours. Such audits may be performed by any Owner's representative, or any outside representative engaged by Owner for the purpose of examining such records. The Owner or its designee may conduct such audits or inspections throughout the term of this contract and for a period of three years after final payment or longer if required by law. Owner's representatives may (without limitation) conduct verifications such as counting employees at the Construction Site, witnessing the distribution of payroll, verifying information and amounts through interviews and written confirmations with Contractor employees, field and agency labor, subcontractors, and vendors.
2. Contractor's "records" as referred to in this Exhibit shall include any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in Owner's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document. Such records shall include (hard copy, as well as computer readable data if it can be made available), written policies and procedures; time sheets; payroll registers; payroll records; cancelled payroll checks; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, negotiation notes, etc.); original bid estimates; estimating work sheets; correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; invoices and related payment documentation; general ledger, information detailing cash and trade discounts earned, insurance rebates and dividends; and any other contractor records which may have a bearing on matters of interest to the Owner in connection with the contractor's dealings with the Owner (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of any or all of the following:
  - a) Compliance with contract requirements for deliverables
  - b) Compliance with approved plans and specifications
  - c) Compliance with Owner's business ethics expectations
  - d) Compliance with contract provisions regarding the pricing of change orders
  - e) Accuracy of contractor representations regarding the pricing of invoices
  - f) Accuracy of contractor representations related to claims submitted by the contractor or any of his payees.
3. Contractor shall require all payees (examples of payees include subcontractors, material suppliers, insurance carriers, etc.) to comply with the provisions of this article by including the requirements hereof in a written contract agreement between Contractor and payee. Contractor will ensure that all payees (including those entering into lump sum contracts) have the same right to audit provisions contained in this contract.
4. Owner's authorized representative(s) shall have reasonable access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this contract and shall be provided adequate and appropriate workspace, in order to conduct audits in compliance with this article.
5. If an audit inspection or examination in accordance with this article, discloses overpricing or overcharges to the Owner (of any nature) by the Contractor and/or the Contractor's Subcontractors in excess of \$100,000 in addition to making adjustments for the overcharges, the reasonable actual cost of the Owner's audit shall be reimbursed to the Owner by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of Owner's findings to Contractor.

## Section CC

### **Right of Audit – Records to Be Provided to Owner’s Representatives Upon Request**

In addition, to the normal paperwork documentation the Contractor typically furnishes to the Owner, in order to facilitate efficient use of Owner resources when reviewing and/or auditing the Contractor’s billings and related reimbursable cost records, the Contractor agrees to furnish (upon request) the following types of information in the specified computer (PC) readable file format(s):

Type of Record	PC Readable File Format
Monthly Job Cost Detail	.pdf and Excel
Detailed job Cost History To Date	.pdf and Excel
Monthly Labor Distribution detail (if not already separately detailed in the Job Cost Detail)	.pdf and Excel
Total Job to date Labor Distrubution detail (if not already included in the detailed Job Cost History to date)	.pdf and Excel
Employee Timesheets documenting time worked by all individuals who charge reimbursable time to the project	.pdf
Daily Foreman Reports listing names and hours and tasks of personnel who worked on the project	.pdf
Daily Superintendent Reports	.pdf
Detailed Subcontract Status Reports (showing original subcontract value, approved subcontract change orders, subcontractor invoices, payment to subcontractors, etc.	.pdf and Excel
Copies of Executed Subcontracts with all Subcontractors	.pdf
Copies of all executed change orders issued to Subcontractors	.pdf
Copies of all documentation supporting all reimbursable job costs (subcontractor payment applications, vendor invoices, internal cost charges, etc.)	.pdf

## SECTION 01 10 00

### SUMMARY OF WORK

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION OF WORK

- A. Project, **2024 Cy Creek HS Renovation**, with campus locations at the following addresses:
- 9815 Grant Rd., Houston, Texas 77070
- for the Cypress-Fairbanks Independent School District.
- B. The Project(s) consists of but is not limited to:  
Provide Orchestra addition of rehearsal hall and practice rooms. Provide new green house, renovate industrial Tech Computer and Electronics Rooms. Renovate Black Box Theater, provide addition for two new art rooms, replace ceiling with new acoustical lay-in ceiling tile and grid throughout facility, paint all previously painted surfaces, provide auxiliary music rehearsal room, replace structural expansion joint covers, remove and replace floor tile and wall tile finishes, replace paint booth, strip down and refinish floors in auxiliary and competition gyms, provide 2 additional tennis courts, provide new cap sheet to existing mod bit roofing membrane, improvement for on-site car and bus vehicular stacking, replace secondary switchgear, provide generator backed power for all racks in all telecommunications rooms, renovate kitchen and expand server, replace boiler.
- C. Project Schedule:
1. Substantial Completion date: July 26, 2026
  2. General phasing requirements refer to Part 3.1.B below.

##### 1.2 CONTRACTS AND USE OF SITE

- A. Contractor Use of Premises:
1. Confine operations at site to areas permitted by law, permits, and Contract Documents, or as required to maintain campus operations (as approved by Owner).
  2. Do not unreasonably encumber site with materials or equipment. Refer to Contractor lay-down areas indicated on plans. If not indicated on plans provided, Contractor to submit for approval proposed Contractor designated areas, including but not limited to: lay-down, staging, parking, restroom, trailer, dumpster, field office, etc.
  3. Assume full responsibility for protection and safekeeping of products stored on premises.
  4. Obtain and pay for use of additional storage or work areas as needed for operations.
  5. Contractor shall establish secured staging area for work and coordinate and provide for safe passage and exit from existing building areas during construction, in compliance with all applicable codes and requirements of Owner.
  6. During phased construction, Contractor shall provide maps of building to Owner for each phase, showing construction area and impact to other areas of the building.
  7. Contractor shall coordinate all construction activities with school district officials.
  8. Owner reserves the right to perform construction operations with its own forces or to employ separate contractors on portions of the Project. General Contractor shall coordinate with Owner-performed work in terms of providing site access, workspace, and storage space, cooperation of work forces, scheduling, and technical requirements.

9. Noise Control: Contractor shall coordinate equipment locations and timing of work activities so as to avoid conflict with the building occupants and/or avoid interference with facility meetings, events, or other activities.
  10. Utilities. The contractor is to coordinate all utilities permanent and temporary and make arrangements for installation for any service easements once the Owner provides information that a blanket or final easement exists.
  11. Project Fencing:
    - a. Upon mobilization, the contractor shall build a wire mesh fence (or other type) as directed by Owner, at least six (6) feet high as shown on site plan and/or discussed during the pre-construction meeting.
    - b. Site fencing shall include emergency service and trucking gated in locations shown on the site plan and/or discussed during the pre-construction meeting.
    - c. Contractor shall properly maintain fencing and gates until Substantial Completion and only remove with concurrence from the Owner.
- B. Owner Occupancy:
1. Refer to AIA Document A201™–2017, as amended.
- C. Owner-Furnished/Owner-Installed Items:
1. The Owner reserves the right to place and install equipment in construction areas of the building prior to Substantial Completion, provided that such occupancy does not interfere with completion of the Work. Such placing of equipment shall not constitute acceptance of the total Work. Contractor shall protect Owner's property.
- D. Owner-Furnished/Contractor-Installed Items:
1. The Owner may provide items to the Contractor for installation in accordance with manufacturer's recommendation and instructions.
  2. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule and will inspect deliveries for damage.
  3. If Owner-furnished items are damaged, defective or missing, through no fault of the Contractor, the Owner will arrange for replacement.
  4. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner-furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to elements, and to repair or replace items damaged as a result of his operations.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Refer to Specification Sections.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION SCHEDULE**

#### **A. GENERAL DESCRIPTION OF WORK TO BE PERFORMED UNDER THIS CONTRACT**

The Work to be performed under this contract shall commence on Notice to Proceed and shall be Substantially Complete as stipulated by AIA Document A101™–2017, as amended.

#### **B. GENERAL CONSTRUCTION PHASING REFERENCING CFISD NEEDS BELOW, SHALL BE INCORPORATED INTO THE CONTRACT, INCLUDING BUT NOT LIMITED TO:**

For the summer of 2025:

- Contractors may take over the building June 2, 2025.
- All athletic areas are to remain fully occupiable for the duration of the summer. Any work in the athletic areas will need to be coordinated with the campus. For gym work, only one gym can be under construction at any given time.
- All athletic, fine arts, dance, and cafeteria areas must be fully occupiable no later than July 15, 2025.
- The balance of the building shall be fully occupiable and turned back over to the district no later than July 27, 2025.
- Occupiable includes, but is not limited to, all life safety, MEP, architectural finishes in place, clean, and functioning as intended.
- Only work that can be removed and re-installed by these dates shall be performed during the summer.
- No partially complete work will be allowed after these dates unless approved in advance by the Owner.
- After these dates, all work shall be performed after hours, nights and weekends, while fully coordinating with the campus.

For the summer of 2026:

- Contractors may take over the building June 1, 2026.
- All athletic areas are to remain fully occupiable for the duration of the summer. Any work in the athletic areas will need to be coordinated with the campus. For gym work, only one gym can be under construction at any given time.
- All athletic, fine arts, dance, and cafeteria areas must be fully occupiable no later than July 15, 2026.
- The balance of the building shall be **SUBSTANTIALLY COMPLETE**, fully occupiable, and turned back over to the district no later than July 26, 2026.
- Occupiable includes, but is not limited to, all life safety, MEP, architectural finishes in place, clean, and functioning as intended.
- Only work that can be removed and re-installed by these dates shall be performed during the summer.
- No partially complete work will be allowed after these dates unless approved in advance by the Owner.
- After these dates, all work shall be performed after hours, nights and weekends, while fully coordinating with the campus.

#### **Furniture Campus**

This campus is receiving new student and administrative furniture via separate contract. However, General Contractor to comply with the following:

General Contractor to coordinate with CFISD and CFISD's vendor to provide interior and exterior clear unobstructed paths and access points for deliveries, product staging, product assembly, setup and disposal.

These areas must be available no later than July 15, 2025 and July 15, 2026 respectively.

- Delivery points will be accessible, clear and drivable by numerous eighteen wheeler trucks over a period of several weeks at middle and high schools.
- Staging/assembly areas include but are not limited to commons cafeteria, gyms, large group instruction, larger hallways (not impeding HCFMO fire egress), etcetera.
- Phased installation may include but not be limited to first setting up administration areas then academic classrooms, and finally ancillary support spaces last possibly spilling over from Summer into Thanksgiving week, Winter Break and Spring Break week if necessary
- As a guide, it is anticipated middle school furniture requires 2-3 weeks and high schools 3-4 weeks for phased installations.

**New Fire Alarm System**

Existing fire alarm system to be replaced with all new system for the entire building including the addition(s). Existing fire alarm system to remain fully operational and monitored for the duration of the project until the new fire alarm system is inspected and approved by AHJ. Once new system is inspected and approved, all components associated with existing fire alarm to be fully removed. Refer to specification and drawings.

**END OF SECTION**



## SECTION 01 11 23

### CODES, REGULATIONS AND STANDARDS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Quality Assurance
- B. References Standards
- C. Definitions
- D. Format and Specification Context Explanations
- E. Abbreviations
- F. Drawing Symbols
- G. General Requirements

##### 1.2 QUALITY ASSURANCE

- A. General:
  - 1. For products or Workmanship specified by a standard of an association, trade, or Federal standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable code authorities having jurisdiction.
  - 2. The contractual relationship of the parties to the Contract should not be altered from the Contract Documents by mention or inference otherwise in any reference standard.
  - 3. Obtain copies of standards when required by Contract Documents.
  - 4. Maintain copy of standards at jobsite during submittals, planning, and progress of the specific Work for which the standards pertain, until the date of Substantial Completion.
  - 5. In the absence of specific instructions in the specifications, materials, products, equipment and their installation shall conform to the applicable codes, regulations and standards specified therein. When a conflict exists between the applicable code, regulation and standard and that specified, the more stringent code regulation or standard shall prevail, except as authorized by applicable authorities having jurisdiction.
- B. Industry Standards: Where compliance with two (2) or more industry standards or sets of requirements is specified and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement is intended and will be enforced, unless specifically detailed language written into the Contract Documents clearly indicates that a less stringent requirement is to be fulfilled. Refer questions to the Architect for a decision before proceeding.
- C. Contractor's Option: Except for overlapping or conflicting requirements, where more than one (1) set of requirements are specified for a particular unit of Work, the option shall be Contractor's regardless of whether or not it is specifically indicated as such.
- D. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended to be the minimum for the Work to be performed or provided. Except as otherwise specifically indicated, the actual Work shall either comply exactly with the minimum (within specified tolerances). In complying with requirements, indicated numeric values are either minimums or

maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Architect for decision before proceeding.

- E. Specialists; Assignments: In certain instances, specification text requires (or implies) that specific Work is to be assigned to specialists. Such Work shall be accomplished by the specified specialist. These requirements should not be interpreted so as to conflict with applicable regulations, union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as “expert” for the indicated construction processes or operations. Notwithstanding any such designation, the final responsibility for fulfillment of all Contract requirements remains with the Contractor.

### 1.3 REFERENCE STANDARDS

- A. Dates of codes, regulations and standards specified shall be the latest date of issue of that code, regulation or standard prior to the date of issue of this Project Manual or Document, except as modified or otherwise directed by the applicable codes and their supplements and amendments adopted by the code authorities having jurisdiction.
  - 1. Date of Issue - The “date of issue” as it appears in the statement above, means the date which appears on the cover of the Project Manual or Document corresponding to the date of issue of the Contract Documents.
  - 2. Code Authorities: The “code authorities” as it appears in the statement above, means the International Building Code (IBC) with City of Houston Amendments, Harris County Regulations, and those authorities responsible for code enforcement.

### 1.4 DEFINITIONS

- A. General Explanation: A substantial amount of specification language consists of definitions for terms found in other Contract Documents, including those in the AIA A201 General Conditions of the Contract for Construction as amended, Supplementary Conditions, the Drawings, and the Specifications. Drawings must be recognized as being diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in the Contract Documents are defined in the General Conditions, Supplementary Conditions, and in this Section. Definitions and explanations contained in this Section are not necessarily either complete or exclusive but are general for this Work to the extent that they are not stated more explicitly in another element of the Contract Documents. In the event of a conflict in definitions or explanations within the Contract Documents or whenever there is need of clarification or interpretation of definitions within or between the Contract Documents, notify the Architect immediately and proceed as directed. Except in cases where definitions are determined by code authorities having jurisdiction, the Architect’s interpretation of all definitions will take precedence.
- B. General Requirements: The provisions or requirements of Division 1 - Sections apply to entire Work of Contract and, where indicated, to other elements which are included in the Project.
- C. Special Conditions: Wherever the term “Special Conditions”, appears in the Contract Documents, it refers collectively to all requirements of the Owner in addition to the sections in Division 1, General Requirements, and to Articles contained in the General Conditions and Supplementary Conditions.
- D. Architect: Wherever the term “Architect” appears in the Contract Documents, it means VLK Architects or their authorized representative(s).
- E. Bid, Competitive Sealed Proposal (CSP), Response, Offer, etc.: Wherever the term “Bid”, “Competitive Sealed Proposal (CSP)”, “Response”, “Offer”, “Proposal”, or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall mean Competitive Sealed Proposal, which by definition allows the Owner to accept the “best value” for the school district based on factors other than cost in selecting the Contractor.

- F. Contractor, General Contractor, etc.: Wherever the term “Contractor”, “General Contractor”, “Prime Contractor”, “Bidder”, “Bidder/Vendor”, “Vendor”, “Installer”, “Integrator”, “Subcontractor”, “Respondent”, “Offeror”, or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall refer to the entity (person or firm) licensed and meeting all applicable regulations of the State of Texas and Department of Labor to perform the Work, or their authorized representative(s).
1. Responsibilities: To avoid any misunderstanding or lack of interpretation, the responsibility for performing the Work is totally that of the entity defined above, and the resolutions proposed in his shop drawings and related documentation shall be demonstrated throughout the Work and specified warranty period.
  2. In the event of a controversy involving the Contract Documents or interpretation of Project requirements, the decision of the Architect will take precedence.
- G. Consultant: Wherever the term “Consultant”, or any derivative thereof appears in the Contract Documents, it means the following:
1. Owner's Consultants:
    - a. Third Party Plan Reviewer: Winning Way
    - b. Materials Testing: Ninyo & Moore
    - c. Roof Inspection: Raba Kistner
    - d. Mechanical Testing and Balancing: Campos
    - e. Commissioning: Campos
  2. Architect's Consultants:
    - a. Civil Engineer: Brooks & Sparks
    - b. Structural Engineer: Dunaway
    - c. MEP Engineer: Salas O'Brien
    - d. Landscape Consultant: Westwood
    - e. Roofing Consultant: TBD
    - f. Food Service Consultant: FDP
    - g. Asbestos Abatement Consultant: EFI Global, Inc.
    - h. Geotechnical Engineer: Terracon, Inc.
    - i. Traffic Engineer: Traffic Engineers Inc.
    - j. Acoustical Engineer: WJHW
- H. Indicated: Wherever the term “indicated”, or any derivative thereof appears in the Contract Documents, it means a cross-reference to graphic representations, notes, or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in the Contract Documents. Where terms such as “shown”, “noted”, “scheduled”, and “specified” are used in lieu of “indicated”, it is for the purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.
- I. Directed, Requested, Etc.: Where not otherwise explained, terms such as “directed”, “requested”, “authorized”, “selected”, “approved”, “required”, “accepted”, and “permitted” or any derivative thereof appears in the Contract Documents, it means as “directed by the Architect”, “requested by the Architect”, and similar phrases with actions taken by the Architect. However, no meaning or otherwise shall be interpreted to extend the Architect's responsibility into Contractor's area of construction supervision.
- J. Approve: Wherever the term “Approve”, or any derivative thereof appears in the Contract Documents, it means only the Architect, or an individual designated by him as his representative, can approve or disapprove contract actions. Even if the specifications indicate that an individual other than the Architect, such as the “Engineer” or “Consultant” will approve or disapprove an action, it is understood that only the Architect has this authority unless the individual is so designated by him in writing. Even when an individual is so designated, the Contractor may appeal the action to the Architect and the Architect's decision will be final. In no case will “approval” by the Architect

be interpreted as a release of the Contractor from responsibility to fulfill requirements of the Contract Documents.

- K. **Furnish:** Wherever the term “Furnish”, or any derivative thereof appears in the Contract Documents, it means supply or deliver to Project site, ready for unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.
- L. **Install:** Wherever the term “Install”, or any derivative thereof appears in the Contract Documents, it means performing the operations at the Project site, of unloading, unpacking, assembly, erection, placing, installing, anchoring, applying, curing, finishing, protecting, cleaning and similar operations, as applicable in each instance.
- M. **Provide:** Wherever the term “Provide”, or any derivative thereof appears in the Contract Documents, it means furnish and install at the Project site, complete and ready for intended use, as applicable in each instance.
- N. **Project, Site:** Wherever the term “Project”, “Site”, or similar such term appears in the Contract Documents, it means the space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing Work as part of the Project. The extent of project or site is shown on the Drawings and may or may not be identical with description of land upon which Project is to be built.
- O. **District, School District, Owner, etc.:** Wherever the term “District”, “School District”, “Owner”, “Cy-Fair ISD”, “CFISD”, or similar such term appears in the Contract Documents, it means Cypress-Fairbanks Independent School District, 11430 Perry Road, Houston, Texas 77064, (281) 897-4057, or its authorized representative(s).
- P. **Installer:** Wherever the term “Installer”, or any derivative thereof appears in the Contract Documents, it means the 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, including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.
- Q. **Specialist:** Wherever the term “Specialist”, or any derivative thereof appears in the Contract Documents, it means an individual or firm of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of Workmen skilled in either (as applicable) manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing Work required by the Contract. Where the Contract Specification requires installation by a specialist, that term shall also be deemed to mean either the manufacturer of the item or firm who will perform the Work under the manufacturer’s direct supervision.
- R. **Testing Laboratory:** Wherever the term “Testing Laboratory”, or any derivative thereof appears in the Contract Documents, it means an independent entity engaged to perform specific inspections or tests of the Work, either at the Project site or elsewhere; and to report and (if required) interpret results of those inspections or tests.

## **1.5 FORMAT AND SPECIFICATION CONTEXT EXPLANATIONS**

- A. **Underscoring:** Is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where underscoring is used.
- B. **Capitalization:** Except for manufacturer, product, or trademark names, capitalization is used strictly to assist reader of specification text in scanning text for key words (for quick recall). No emphasis on or relative importance is intended where capitalization is used.

- C. Imperative language: Is used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by the Contractor, or when so noted, by others.
- D. Section Numbering: Is used to facilitate cross-reference in Contract Documents. Sections are placed in Project Manual in numeric sequence; however, numbering sequence is not complete, and listing of sections at beginning of Project Manual must be consulted to determine numbers and names of specification sections in Contract Documents.
- E. Page Numbering: Pages are numbered independently for each section. The section number is shown preceded by the project number and followed by the page number at the bottom of each page, to facilitate the location of text. The project number is given to identify the project, for which specification was written, should the section become separated from the Project Manual.
- F. Specifying Methods: The techniques or methods of specifying to record requirements varies throughout text, and may include “prescriptive”, “open-generic descriptive”, “compliance with standards”, “performance”, or a combination of these. The method used for specifying one unit of Work has no bearing on requirements for another unit of Work.

## 1.6 ABBREVIATIONS

- A. The language of Specifications and other Contract Documents is of the abbreviated type in certain instances and implies words and meanings which will be appropriately interpreted. Actual Work abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations 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. Trade association names and titles of general 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 the Contract Documents so indicates. A list of typical abbreviations includes but is not limited to the following trade associations and organizations. Refer to Drawings and other Contract Documents for other abbreviations.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Assn.
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
AGA	American Gas Association
AGC	Associated General Contractors of America
AHA	American Hardboard Association
AHGA	American Hotdip Galvanizers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning & Refrigeration Institute
ASA	Acoustical Society of America
ASA	American Subcontractors Association
ASC	Adhesive & Sealant Council, Inc.
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Professional Engineers

ASAH	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASPI	American Wood Preserver's Institute
ASTM	ASTM International
AWI	Architectural WoodWork Institute
AWS	American Welding Society
BIA	Brick Institute of America
BRI	Building Research Institute
CRA	California Redwood Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute
DHI	Door and Hardware Institute
EPA	Environmental Protection Agency
FTI	Facing Tile Institute
FGMA	Flat Glass Marketing Association
GA	Gypsum Association
HPMA	Hardwood Plywood Manufacturers Association
IBC	International Building Code
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
JSMA	Joint Sealer Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAMM	National Association of Mirror Manufacturers
NBLP	National Bureau of Lathing & Plastering
NCPI	National Clay Pipe Institute
NCMA	National Concrete Masonry Association
NEMA	National Electrical Manufacturers Assn.
NESC	National Environmental Systems Contractors
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NHLA	National Hardwood Lumber Association
NOMMA	National Ornamental Metal Manufacturers Assn
NPVLA	National Paint, Varnish and Lacquer Assn.
NRMCA	National Ready Mixed Concrete Assn.
NRCA	National Roofing Contractors Association
NSPE	National Society of Professional Engineers
NWMA	National WoodWork Manufacturers Assn., Inc.
OSHA	Occupational Safety and Health Administration
PDCA	Painting and Decorating Contractors of America
PI	Perlite Institute, Inc.
PCA	Portland Cement Association
RFCI	Resilient Floor Covering Institute
RVFC	Rubber and Vinyl Floor Council
SBCCI	Southern Building Code Congress International, Inc.
SFPA	Southern Forest Products Association
SHLMA	Southern Hardwood Lumber Manufacturing Assn.
SDI	Steel Deck Institute
SDI	Steel Door Institute
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UBC	Uniform Building Code

UL	Underwriter's Laboratories, Inc.
VBI	Venetian Blind Institute
VFI	Vinyl Fabrics Institute
WCLIB	West Coast Lumber Inspection Bureau
WRCLA	Western Red Cedar Lumber Association
WWPA	Western Wood Products Association

## 1.7 DRAWING SYMBOLS

- A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols defined by "Architectural Graphic Standards", published by the American Institute of Architects (AIA) and John Wiley & Sons, Inc., latest edition. Refer instances of uncertainty to Architect for clarification before proceeding.
- B. Mechanical/Electrical Drawings: Graphic symbols used in Mechanical/Electrical Drawings are generally aligned with symbols recommended by American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Where appropriate, those symbols are supplemented by more specific symbols as recommended by other recognized technical organizations, including, but not limited to American Society of Mechanical Engineers (ASME), American Society of Professional Engineers (ASPE), Institute of Electrical and Electronic Engineers (IEEE) and similar organizations. Refer instances of uncertainty to Architect for clarification before proceeding.

## 1.8 GENERAL REQUIREMENTS

- A. Color, Texture, or Pattern Requirements:
1. When color, texture, or pattern is specified, the item, product, or material shall be furnished in the specified color, texture, or pattern, as applicable.
  2. When more than one (1) approved manufacturer is named in the Specifications, Contractor may select any of the approved manufacturers and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect's review and selection.
  3. When the term "match existing", or any derivative thereof appears in the Contract Documents, it means that the sample must match the Owner's existing Work in every respect as to color, texture, and pattern, as applicable.
  4. When the term "match Architect's approved sample", or any derivative thereof appears in the Contract Documents, it means that the Architect has selected a sample which must be matched in every respect as to color, texture, and pattern, as applicable.
  5. When an item or product is specified of a manufacturer for which only one (1) color, texture, or pattern is available, and a color, texture, or pattern other than that one is specified, Contractor shall bring it to the attention of the Architect for a decision prior to proceeding with the Work. Do not proceed with the Work until Architect has approved the color, texture, and pattern, as applicable.
  6. When an item or product is specified of a manufacturer for which no color, texture, or pattern is specified, and colors, textures, and patterns are available, Contractor shall bring it to the attention of the Architect and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect's review and selection. Do not proceed with the Work until Architect has selected and approved the color, texture, and pattern, as applicable.
  7. When due to the nature of the item, product, or material, i.e., face brick, tile pavers, natural stone, etc, Contractor shall submit sample or samples which exhibits the full range of characteristics (colors, i.e. lights and darks, as well as textures, and patterns) for which the item, product, or material is available. The Architect will select the color, texture, and pattern, as applicable, from those available and request a sample panel exhibiting the approved characteristics. The approved color range, texture, and pattern, as applicable will then

- become the standard for which all Work on the project will be judged. Architect will be final judge as to having performed Work in conformance with approved characteristics.
8. Under no circumstances are colors, textures, patterns, or any other characteristics for which an item, product, or material are available to be selected by anyone other than the Architect or Owner.
  9. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.
- B. Continuity of Building Envelope, Full Height Partitions, and Fire Rated Construction:
1. Continuity of Building Envelope:
    - a. All materials such as exterior sheathing, membrane flashings, vapor barriers, insulations, dampproofing, waterproofing, roofing, flashings, etc. and all penetrations, holes, gaps, joints, and openings through such materials shall be sealed to ensure continuity of building envelope, whether indicated or not to eliminate moisture penetration.
    - b. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
  2. Full Height Partitions:
    - a. All full height partitions shall be from floor to bottom of deck structure and shall be made to fit around steel joists, beams, etc., whether indicated or not.
    - b. Seal joints at top of partitions, in flutes of steel deck, and around structural elements with a compressible filler and/or sealant to accommodate movement due to expansion, contraction, and deflection, whether indicated or not. Treat seals in joints of fire rated partitions as specified below for fire rated construction, whether indicated or not.
    - c. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
  3. Fire Rated Construction:
    - a. All seals in fire rated construction, whether at top, bottom, or penetrations through fire rated construction, shall be made with firestopping and firesafing materials to maintain fire rating integrity of construction and satisfy authorities having jurisdiction, whether indicated or not.
    - b. Refer instances of uncertainty to Architect for clarification before proceeding with Work.
- C. Plumbing Line Protection:
1. Placing or washing materials, including, but not limited to the following, down any plumbing line or fixture is strictly forbidden.
    - a. Concrete, cement, sludge, mortar, grout, plaster, or any other cementitious material
    - b. Paint, paint thinner, turpentine, kerosene, gasoline, oil, or any other petroleum or hazardous products.
  2. Cleaning painting equipment, including brushes in new or existing plumbing fixtures is strictly prohibited.
  3. Contractor shall certify that all affected plumbing lines and fixtures are clean, free flowing and running. Plumbing lines and fixtures damaged as a result of any of the above shall be repaired or replaced at no expense to Owner. Contractor shall bear responsibility and all costs of fines, penalties, and legal fees attributed to violations as levied by authorities having jurisdiction.
- D. Support from Structure: Ducts, pipes, conduits, equipment, and other items indicated to be supported from the structure shall be accomplished using approved hangwires, hangers, or devices of type, size and material recommended to suit the application and installed in accordance with recommendations of the hanger or device manufacturer, Architect and/or Structural Engineer, or code authorities having jurisdiction, whichever is the more stringent requirement. Nothing shall be hung from the structure unless directed to do so by the Architect and/or Structural Engineer.



- E. Ducts, Pipes, Conduits, and Wires: Shall be concealed in walls, chases, and enclosed areas out of view, unless specifically indicated as exposed or where exposure is required for proper function of item, such as air registers, air returns, louvers, grilles, vents, thermostats, electrical receptacles, telephone/data terminals and jacks, light switches, etc. Refer instances of uncertainty to Architect for clarification before proceeding.
- F. Fasteners:
  - 1. Unless specifically indicated or directed otherwise, all fasteners in Work exposed to view, shall be concealed in the finished Work.
  - 2. No fasteners shall show through or telegraph through exposed face of finished Work and all finished surfaces shall be free of all evidence of the existence of fasteners.
  - 3. Fasteners shall be spaced to accurately and rigidly secure Work in place.
  - 4. If not shown or otherwise required or recommended by manufacturer, standard, or code authorities having jurisdiction, fastener spacing shall not exceed 12 inches on center.
  - 5. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.
- G. Exposed Metal Work:
  - 1. Unless specifically indicated or directed otherwise, all exposed metal Work shall be flat with all surfaces free of distortions, oil canning, waves, dents, scratches, weld marks, and other surface defects detrimental to good appearance or function.
  - 2. All steel exposed to exterior shall be hot-dip galvanized, phosphate treated for paint retention and shop prime painted.
  - 3. Non-conforming Work shall be removed from the site and replaced with new conforming Work at no additional expense to Owner.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

Not Used

**END OF SECTION**



## SECTION 01 11 26

### OWNER/ARCHITECT PROVIDED DOCUMENTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 - GENERAL

##### 1.1 COPIES OF SUPPLEMENTARY CONTRACT DOCUMENTS

- A. The Owner and Architect have included the following Supplementary Contract Documents for the Offerors information. The Owner and Architect **do not** guarantee the accuracy, completeness, or suitability of this information, and the Offerors should verify the existing conditions prior to the Proposal date.
- 1. Topographic Survey:
    - 1. Entitled: Cypress Creek High School
    - 2. Prepared for: Cypress-Fairbanks ISD
    - 3. Prepared by: WestBelt Survey, Inc.
    - 4. Dated: May 1, 2024
  - 2. Geotechnical Investigation Report – Refer to Section 02 32 00
    - 1. Entitled: CFISD Cypress Creek High School Improvements Geotechnical Engineering Report
    - 2. Prepared for: VLK Architects
    - 3. Prepared by: Terracon
    - 4. Dated: October 3, 2024
- B. The boring log from the above-mentioned soils report is included in Section 02 32 00, Geotechnical Investigation.
- C. Any of the above documents bound in the drawing or specifications are included for reference purposes only.
- D. Neither Architect nor Owner guarantees their contents as to accuracy, completeness, or suitability.
- E. Copies may be examined at the Architect's office.

#### PART 2 - PRODUCTS

Not Used

#### PART 3 - EXECUTION

Not Used

**END OF SECTION**



## SECTION 01 21 00

### ALLOWANCES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to the Section.

#### PART 1 – GENERAL

Refer to Document AB for Substitutions of Materials and Equipment

##### 1.1 CONDITIONS

- A. ALLOWANCES shall be included in the Contract sum as specified within this Specification Section in paragraph 3.1 below. These sums shall be reconciled as per AIA Document A201™–2017, as amended.
- B. Where allowances are for materials only, the cost of delivery to the job site may be funded from such allowance.
- C. Allowances are hereby established for the items in the amounts listed below. If any items exceed the amount listed, such excess cost shall be paid by the Owner. If any items cost less than the amount listed, the Owner shall be given a credit in the amount of the difference. Costs of items listed below are to be net costs to the General Contractor or Subcontractor, whichever makes the direct purchase.
- D. The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. These allowances shall cover the net cost of the materials and equipment delivered and unloaded at the site, and all applicable taxes.
  - 1. The Contractor's handling costs on site, labor, installation cost, estimating, labor burden, overhead, profit and other expenses contemplated for the original allowances shall be included in the Contractor's Sum and not in the allowance. Subcontractor and sub-subcontractor markups are allowable as provided in AIA Document A201™–2017, as amended.
  - 2. The Contractor shall cause the work covered by these allowances to be performed for such amounts and by such persons as the Architect may direct, but he will not be required to employ persons against whom he makes reasonable objection.
  - 3. The cost, when determined, is more than or less than the allowance, the Contract Sum shall be adjusted accordingly by Change Order which may include additional handling costs on the site, labor, installation costs, overhead, profit, cleaning, as-builts, standard warranty, cost to update electronic record documents and other expenses resulting to the Contractor from any increase over the original allowance if approved.
- E. Contractor shall proceed with the work in question only after receiving written directions executed by the Owner and the Architect. Owner will not be obligated to pay the cost of any work without prior authorization. This written directive shall consist of Owner's representative and Architect's signature on Change Proposal Request document submitted by General Contractor with any applicable amendments if required indicating such approval. The Architect and Owner shall respond in a timely manner to document approved Change Proposal Request (CPR) expenditures and credits from such allowances within the contract. The Contractor may request payment for such approved expenditures only upon completion of the work and the completion of a fully executed CPR formally documenting allowance expenditure credits. The Contractor's overhead and profit relative to these allowance sums and work performed in accordance herewith, shall be included in the total Proposal prices, thus not included in the allowance sum. Unexpended balance of allowance sums shall revert to the Owner by Change Order in the final settlement of the contract.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

### **3.1 ALLOWANCES**

- A. Owner's Betterment Allowance: \$2,801,200.00
1. Contractor shall include the amount indicated above in his Base Proposal as a contingency to cover the cost of additional scope of work. Contractor shall proceed with the work in question only after receiving written directions executed by the Owner and the Architect. Owner will not be obligated to pay the cost of any work performed without prior written authorization. The Contractor's overhead and profit relative to this contingency sum and work performed in accordance herewith, shall be included in the total Base Proposal price, but not included in the contingency sum. Unexpended balance of contingency sums shall revert to the Owner via Change Order during project closeout. Other scopes to be funded from this allowance may include, but are not limited to:

Furniture Moving and Relocation  
Furniture Dumpster  
Shop Relocation  
TDLR Allowance  
BMCS Allowance  
Emergency Radio Repeater  
MUD/Utility  
Promethean Board Moving & Storage  
Video Surveillance Agreement License Upgrade  
Weight Room Relocation

**END OF SECTION**

## **SECTION 01 22 00**

### **MEASUREMENT AND PAYMENT (UNIT PRICES)**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

Refer to Document AB for Substitutions of Materials and Equipment

##### **1.1 SECTION INCLUDES**

- A. Measurement and payment criteria applicable to portions of the Work performed under a unit price payment method.
- B. Defect assessment and non-payment for rejected work.

##### **1.2 AUTHORITY**

- A. Measurement methods delineated in the individual specification sections complement the criteria of this Section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. The Architect will verify measurements and quantities.

##### **1.3 UNIT QUANTITIES SPECIFIED**

- A. Quantities indicated in the Contract Documents are for bidding and contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Architect determine payment.
- B. If the actual Work requires more or fewer quantities than those quantities indicated, provide the required quantities at the unit sum/prices contracted.

##### **1.4 MEASUREMENT OF QUANTITIES**

- A. Measurement Devices:
  - 1. Weigh Scales: Inspected, tested, and certified by the applicable State Weights and Measures Department within the past year.
  - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
  - 3. Metering Devices: Inspected, tested, and certified by the applicable State department within the past year.
- B. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- C. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- D. Measurement by Area: Measured by square dimension using mean length and width or radius.
- E. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- F. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

## **1.5 PAYMENT**

- A. Payment Includes: Full compensation for all required labor, labor burden, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.
- B. Final payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities confirmed and accepted by the Architect multiplied by the unit/sum price for work which is incorporated in or made necessary by the Work.

## **1.6 DEFECT ASSESSMENT**

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price reduction.
- C. The authority of the Architect to assess the defect and identify payment adjustment is final.

## **1.7 NON-PAYMENT FOR REJECTED PRODUCTS**

- A. Payment will not be made for any:
  - 1. Products wasted or disposed of in a manner that is not acceptable.
  - 2. Products determined as unacceptable before or after placement.
  - 3. Products not completely unloaded from the transporting vehicle.
  - 4. Products placed beyond the lines and levels of the required work.
  - 5. Products remaining on hand after completion of the work.
  - 6. Loading, hauling and disposing of rejected Products.

## **PART 2 – DESCRIPTION OF UNIT PRICES**

### **2.1 GENERAL**

- A. For the work described unit pricing shall be used to determine the additional cost or credit to the contract amount or added to or deducted from the Owner's contingency for changes in the scope of work made during the progress of the work as directed by Architect.
- B. The same price shall be used for adding or deducting from the scope of work. No exceptions.
- C. The following unit prices shall be included in the proposal form and shall be included in the Owner-Contractor agreement.

## **PART 3 - EXECUTION**

### **3.1 SCHEDULE OF UNIT PRICES**

- A. Unit Prices shall be used, where applicable, to make adjustments to the cost of the work due to changes. All Unit Prices submitted shall be complete "turnkey" prices for fully functioning systems, and shall include all costs for overhead, profit, labor, labor burden, material, equipment, and any other incidentals related to the completion of the Work and shall remain firm for the duration of the contract. Unit prices listed are for additive and/or deductive work.



**UNIT PRICE 1: ELECTRICAL DUPLEX RECEPTACLE**

Provide unit price for a new 20A, 120V duplex electrical receptacle and cover plate, flush mounted in a CMU, metal stud, or demountable wall construction, circuited to an existing electrical panel within 150 feet of the outlet using a branch circuit consisting of 2 #10 AWG and 1 #10 AWG ground in 3/4-inch EMT conduit. All conduits to be concealed in wall construction. Unit price shall include a 20-amp circuit breaker to be installed in existing panel space.

**UNIT PRICE 2: DATA DROP**

Provide unit price for a data drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to an IDF/MDF Room. The data drop shall consist of a single gang wall box, cabling wiring device, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated cabling routed above accessible ceiling to the nearest MDF or IDF location within 250 feet of the outlet. Termination and testing to be included in the unit price.

**UNIT PRICE 3: VOICE DROP**

Provide unit price for a voice drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to the telecommunications/MDF room. The voice drop shall consist of a single gang wall box, voice jack, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated voice cable routed above accessible ceiling to telecommunication head end equipment. Termination and testing to be included in the unit price.

**UNIT PRICE 4: DATA CABLING TO TEACHER STATION**

Provide one data drop, including data jack, faceplate, and CAT 6 cable home run to nearest IDF or MDF data rack. Assume length less than 300 FT. Include J-box and conduit from data outlet to ceiling cavity in this unit price.

**UNIT PRICE 5: 4 ½" THICK CONCRETE WALK PER SQUARE FOOT**

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 4 ½" thick concrete walk (minimum 100 SF) per Square Foot.

**UNIT PRICE 6: 6" THICK CONCRETE DRIVE PER SQUARE FOOT**

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 6" thick concrete drive (minimum 100 SF) per Square Foot.

**UNIT PRICE 7: 7" THICK CONCRETE DRIVE PER SQUARE FOOT**

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 7" thick concrete drive (minimum 100 SF) per Square Foot.

**UNIT PRICE 8: LIFE SAFETY DEVICES (including all associated cabling and programming)**

This unit cost shall establish the amount to be added or deducted from the contract price for the Contractor to add /deduct Fire Alarm devices.

1.	Exterior Horn to Speaker	\$ _____	each
2.	Interior Horn to Speaker	\$ _____	each
3.	Interior Visual Strobe	\$ _____	each
4.	Interior Speaker/Visual Strobe	\$ _____	each
5.	Smoke Detector	\$ _____	each
6.	Heat Detector	\$ _____	each
7.	Manual Pull Station	\$ _____	each
8.	Stopper 2 Pull Station Cover	\$ _____	each

9.	Annunciator Panel	\$ _____	each
10	Duct Detector	\$ _____	each
11	Relay	\$ _____	each
12	Supervisory	\$ _____	each
13	Waterflow	\$ _____	each
14	Amplifier	\$ _____	each
15	Remote Power Supply	\$ _____	each

**UNIT PRICE 9: GRAPHIC SIGNS**

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to remove existing signage and install new as described below:

1.	Sign Type A	\$ _____ /	each
2.	Sign Type B	\$ _____ /	each
3.	Sign Type C	\$ _____ /	each
4.	Sign Type D	\$ _____ /	each
5.	Max Occupancy Signage	\$ _____ /	each
6.	FDC Connection Signage	\$ _____ /	each
7.	Wayfinding Signage (2 lines text)	\$ _____ /	each
8.	Wayfinding Signage (3 lines text)	\$ _____ /	each
9.	Wayfinding Signage (4 lines text)	\$ _____ /	each

**UNIT PRICE 10: PAINTING**

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to paint 100 square feet of wall (minimum 400 square feet of wall).

**UNIT PRICE 11: ASBESTOS ABATEMENT COMPONENTS**

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to add/deduct asbestos abatement components as described below:

No.	Unit Price Description	Add/ Deduct (\$/Figures)	Unit of Measure
ASB-1	Price per square foot for the proper removal, transportation, and disposal of interior <b>ACBM black damp proofing mastic behind brick veneer</b> . All work to be completed in compliance with AHERA and TAPR regulations. – Full Containment	_____	Square Foot
ASB-2	Price per square foot for the proper removal, transportation, and disposal of exterior <b>ACBM black damp proofing mastic behind brick veneer</b> . All work to be completed in compliance with NESHAP regulations.	_____	Square Foot

ASB-3	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM pipe insulation with mastic coating and/or mudded fittings</b> via glovebag removal method including all necessary regulated work area preparation and PPE	_____	Linear Foot
ASB-4	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM pipe insulation with mastic coating and/or mudded fittings</b> . All work to be completed in compliance with AHERA and TAHPR regulations. – Full Containment	_____	Linear Foot
ASB-5	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM tan/cream mastic on duct insulation</b> . All work to be completed in compliance with AHERA and TAHPR regulations. (Full Containment)	_____	Linear Foot
ASB-6	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM tan/cream mastic on duct insulation</b> via glovebag removal method including all necessary regulated work area preparation and PPE	_____	Linear Foot
ASB-7	Price per unit for the proper removal, transportation, and disposal of <b>ACBM “Transite” science tables or fire doors</b> . All work to be completed in compliance with AHERA and TAHPR regulations. (Component Removal)	_____	Unit
ASB-8	Price per linear foot for the proper removal, transportation, and disposal of <b>ACBM underground “Transite” fiber cement pipe</b> via glovebag removal method including all necessary regulated work area preparation and PPE	_____	Linear Foot
ASB-9	Price per linear foot for the proper removal, transportation, and disposal of exterior <b>ACBM underground “Transite” fiber cement pipe</b> . All work to be completed in compliance with NESHAP regulations.	_____	Linear Foot

#### **UNIT PRICE 12: EXIT SIGN**

This unit cost shall establish the amount to be added to the contract price to provide and install one (1) exit sign. Price shall include wiring to nearest available emergency circuit, up to 200 feet. \$ \_\_\_\_\_ / Sign

#### **UNIT PRICE 13: ORNAMENTAL FENCE CARRIERS & WALL REPAIRS**

This unit cost shall establish the amount to be deducted from the contract price to leave existing fixture carrier in place, make all connections removed to inspect carrier and repair wall that was removed to inspect carrier. Wall repair shall include finish to match adjacent finishes included but not limited to tile, paint or other wall finish.

1. Credit for Carrier to remain in place \$ \_\_\_\_\_ / Carrier
2. Wall Repair for Carrier to remain in place \$ \_\_\_\_\_ / Carrier location

**UNIT PRICE 14: CEILING GRID (GRID ONLY RE: DRAWINGS AND SPECIFICATIONS FOR CEILING TILE).**

This unit cost shall establish the amount to be added to the contract price to remove existing ceiling grid and provide and install new ceiling grid (100 SF min.).

**UNIT PRICE 15: TOILET FIXTURE AND CARRIER REPLACEMENT**

1. This unit cost shall establish the amount to be added to the contract price to add a sink and carrier replacement including wall demolition and repair as described in the drawings.
2. This unit cost shall establish the amount to be added to the contract price to add a toilet and carrier replacement including wall demolition and repair as described in the drawings.
3. This unit cost shall establish the amount to be added to the contract price to add a urinal and carrier replacement including wall demolition and repair as described in the drawings.

**END OF SECTION**

## SECTION 01 23 00

### ALTERNATES

#### PART 1 - GENERAL

##### 1.1 ALTERNATE PRICES

- A. Contractor shall state, in the spaces provided in the proposal form, Alternate Prices for the work described below. The responsibility of determining quantity of Alternates rests with the Contractor. Base Proposal and Alternates shall include cost of all supporting elements required, so that no matter what combination of Base Proposal and Alternates are accepted, that portion shall be a complete entity. Work for all Alternates shall be in strict accordance with the specification sections noted and applicable to the specific work.

#### PART 2 - PRODUCTS

Not Used

#### PART 3 - EXECUTION

##### 3.1 ALTERNATES

- A. **Alternate Number 1: Base Bid Adjustment**  
This alternate shall establish the adjustments to the General Contractor's Base Proposal submitted at 2:00 pm, if necessary. This alternate shall be accepted whether it is an add or a deduct and will be used as part of the evaluation process to determine the best value for the District.
- B. **Alternate Number 2A: Chillers by Carrier**  
This alternate shall establish the amount to be added to the Base Proposal for the Contractor to provide all HVAC chillers furnished and installed as manufactured by Carrier as shown on the drawings and listed in the specification. There are no HVAC chillers included in the base bid.
- C. **Alternate Number 2B: Chillers by Daikin**  
This alternate shall establish the amount to be added to the Base Proposal for the Contractor to provide all HVAC chillers furnished and installed as manufactured by Daikin as shown on the drawings and listed in the specification. There are no HVAC chillers included in the base bid.
- D. **Alternate Number 2C: Chillers by Trane**  
This alternate shall establish the amount to be added to the Base Proposal for the Contractor to provide all HVAC chillers furnished and installed as manufactured by Trane as shown on the drawings and listed in the specification. There are no HVAC chillers included in the base bid.

##### 3.2 GENERAL NOTES

- A. Unless otherwise indicated, scope of work for each alternate shall include material and labor, general conditions and all other costs associated with completing the work described.
- B. Alternates are not listed in any order of priority.
- C. Acceptance of alternates shall be the sole discretion of the Owner.
- D. See Section AB for alternate pricing timelines.

END OF SECTION



## **SECTION 01 29 73**

### **SCHEDULE OF VALUES**

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Refer to Instructions to Proposers for substitutions.
- B. 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.

##### **1.2 QUALITY ASSURANCE**

- A. Use required means to assure arithmetical accuracy of the sums described. All calculations shall be to two (2) decimal places.
- 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 and Architect as outlined below:
  - 1. Meet with the Owner and Architect 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 with materials and labor separated. After review by the Owner and Architect, the Schedule of Values shall be broken down into further items as required. (See following list).
- B. Schedule of Values: Refer to the following sample.
- C. Indicate page subtotals on each page of Schedule of Values.
- D. Each page to be printed single-sided.
- E. Schedule of Values is to be submitted for approval per AIA Document A101, Article 3.3

#### **PART 2 – PRODUCTS**

Not Used

#### **PART 3 - EXECUTION**

##### **3.1 SCHEDULE OF VALUES**

- A. Refer to sample attached herein.

**SECTION 01 29 73**  
**SCHEDULE OF VALUES - SAMPLE**

Item No.	Description of Work	Scheduled Value	Work Completed		Stored Matls	Total Completed	%		
			Previous App.	This App.					
	<b><i>NOTE: IF PROJECT CONSISTS OF BOTH NEW ADDITION(S) AND REMODEL (S), EACH SHALL HAVE A SEPARATE SCHEDULE OF VALUES. Listing shall include but not be limited to:</i></b>  <b>Div. 1 - General Conditions</b> Sitework Supervision Mobilization Contractor's Fee General Conditions Temp. Facilities Project sign Coordination drawings Final Cleaning As-Builts/Close-out/O&M Manuals/Record Drawings Permits Bonds Insurance Contractor's written Punch List  <b>Div. 2 - Existing Conditions</b>  <b>Div. 3 - Concrete</b> Drilled Piers Matls Drilled Piers Labor Caps & Beams Matls Caps & Beams Labor Slab on Grade Matls Slab on Grade Labor Cooling Tower Basin Matls Cooling Tower Basin Labor Misc. Bldg Concrete Matls Misc. Bldg Concrete Labor Rebar Matls Rebar Labor Lt. Wt. Insul Fill - Matls Lt. Wt. Insul Fill - Labor Close-out Documents Punch List								



**Div. 4 - Masonry**

Brickwork - Matls  
Brickwork - Labor  
Concrete Masonry - Matls  
Concrete Masonry - Labor  
Str. Glazed Tile - Labor  
Str. Glazed Tile - Matls  
Masonry clean up/acid wash  
Close-out Documents  
Punch List

**Div. 5- Metals**

Structural Steel - Matls  
Structural Steel - Labor  
Misc. Steel - Matls  
  
Steel Joists - Matls  
  
Lt. Gauge Steel Framing - Matls  
Lt. Gauge Steel Framing - Labor  
Metal Decking - Matls  
Metal Decking - Labor  
Expansion Covers - Matls  
Expansion Covers - Labor  
Alternating Stairs Matls  
Alternating Stairs Labor  
Close-out Documents  
Punch List

**Div. 6 - Wood & Plastics**

Rough Carpentry - Matls  
Rough Carpentry - Labor  
Millwork - Matls  
Millwork - Labor

**Div. 7 - Thermal & Moisture Protection**

Waterproofing & Dampproofing Matls  
Waterproofing & Dampproofing Labor  
Building Insulation - Matls  
Building Insulation - Labor  
Fireproofing - Matls  
Fireproofing - Labor  
Metal Roof - Matls  
Metal Roof - Labor  
Metal Roof Guarantee  
Modified Bitumen Roofing Base Sheet- Matls  
Modified Bitumen Roofing Base Sheet - Labor  
Modified Bitumen Roofing Cap Sheet - Matls

Modified Bitumen Roofing Cap Sheet - Labor						
Modified Bitumen Roofing - Guarantee						
Building Sheet Metal - Matls						
Building Sheet Metal - Labor						
Bldg. Sheet Metal Guarantee						
Roof Curbs Matls						
Roof Curbs Labor						
Roof Hatches Matls						
Roof Hatches Labor						
Sealants Matls						
Sealants Labor						
Roof Accessories Matls						
Roof Accessories Labor						
Close-out Documents						
Punch List						

**Div. 8 - Doors & Windows**

Finish Carpentry/Door - Matls						
Finish Carpentry/Door - Labor						
Finish Hardware - Matls						
Finish Hardware - Labor						
Thresholds & Seals Matls						
Thresholds & Seals Labor						
Hollow Metal Doors & Frames - Matls						
Hollow Metal Doors & Frames - Labor						
Plastic Faced Doors - Matls						
Plastic Faced Doors - Labor						
Overhead Doors & Grilles - Matls						
Overhead Doors & Grilles - Labor						
Alum. Entrances & Storefronts - Matls						
Alum. Entrances & Storefronts - Labor						
Alum. Windows - Matls						
Alum. Windows - Labor						
Glass & Glazing - Matls						
Glass & Glazing - Labor						
Glass & Glazing - water test						
Close-out Documents						
Punch List						

**Div. 9 - Finishes**

Lath & Plaster - Matls						
Lath & Plaster - Labor						
Gypsum Wallboard Systems - Matls						
Gypsum Wallboard Systems - Labor						
Ceramic Tile - Matls						
Ceramic Tile - Labor						
Quarry Tile - Matls						
Quarry Tile - Labor						
Terrazzo - Matls						

Terrazzo - Labor						
Acoustic Clg. - Matls						
Acoustic Clg. - Labor						
Acoustic Wall Panels - Matls						
Acoustic Wall Panels - Labor						
Resilient Flooring - Matls						
Resilient Flooring - Labor						
Carpet - Matls						
Carpet - Labor						
Athletic Flooring - Matls						
Athletic Flooring Labor						
Floor Sealer - Matls						
Floor Sealer - Labor						
Painting - Matls						
Paint - Labor						
Close-out Documents						
Punch List						
<b>Div. 10 - Specialties</b>						
Tackboards - Matls						
Tackboards - Labor						
Toilet Partitions - Matls						
Toilet Partitions - Labor						
Louvers - Matls						
Louvers - Labor						
Aluminum Flag Pole - Matls						
Aluminum Flag Pole - Labor						
Graphics -Matls						
Graphics -Labor						
Lockers Matls						
Lockers Labor						
Locker combinations in Excel format						
Demountable Partitions - Matls						
Demountable Partitions - Labor						
Metal Shelving Matls						
Metal Shelving Labor						
Scoreboards - Matls.						
Scoreboards - Labor						
Toilet Room Accessories - Matls						
Toilet Room Accessories - Labor						
Visual Display Boards - Matls						
Visual Display Boards - Labor						
Cubicle Curtains & Track - Matls						
Cubicle Curtains & Track - Labor						
Fire Extinguisher Cabinets Matls						
Fire Extinguisher Cabinets Labor						
Close-out Documents						
Punch List						

**Div. 11 - Equipment**

Stage Curtains Matls  
Stage Curtains Labor  
Stage rigging Matls  
Stage rigging Labor  
Stage lighting Matls  
Stage lighting Labor  
Misc. Appliances Matls  
Misc. Appliances Labor  
Food Service - Submittals/coordination drawings  
Food Service - Walk-ins Matls  
Food Service - Walk-ins Labor  
Food Service - Flatwork - Matls  
Food Service - Flatwork - Labor  
Food Service Eqpt - Labor  
Food Service Eqpt - Matls  
Food Service - Close-out Documents  
Food Service - Training  
Food Service - Kitchen Hoods - Matls  
Food Service - Kitchen Hoods - Labor  
Food Service - Ansul Syst. - Matls  
Food Service - Ansul Syst. - Labor  
Close-out Documents  
Punch List

**Div. 12 - Furnishings**

Casework - Matls  
Casework - Labor  
Science Casework - Matls  
Science Casework - Labor  
Horizontal Blinds - Matls  
Horizontal Blinds - Labor  
Projection Screen - Matls  
Projection Screen - Labor  
Close-out Documents  
Punch List

**Div. 13 - Special Construction**

**Div. 14 - Conveying Systems**

Elevator - Matls  
Elevator - Labor  
Elevator - Maintenance Agreement

**Div. 21 - Fire Suppression**

Fire Sprinkler Syst. - Eng/Submittals  
Fire Sprinkler Syst. - Underground piping/Vault -  
Matls  
Fire Sprinkler Syst. - Underground piping/Vault -

Labor  
Fire Sprinkler Syst. - Above slab piping - Matls  
Fire Sprinkler Syst. - Above slab piping - Labor  
Fire Sprinkler Syst. - Trim-out - Matls  
Fire Sprinkler Syst. - Trim-out - Labor  
Fire Sprinkler Syst. - Start-up/Testing  
Fire Sprinkler Syst. - Close-out Documents  
Close-out Documents  
Punch List

**Div. 22 - Plumbing**

Shop Drawings  
Coordination Drawings  
As-Builts/Close-out O&M Manuals  
Sanitary Underground - Matls  
Sanitary Underground - Labor  
Storm Underground - Matls  
Storm Underground - Labor  
Domestic Water - Matls  
Domestic Water - Labor  
Plumbing Dissolution Matls  
Plumbing Dissolution Labor  
Gas Piping - Matls  
Gas Piping - Labor  
Grease Trap - Matls  
Grease Trap - Labor  
Fixtures - Matls  
Fixtures - Labor  
Rodding/Camera lines

**Div. 23 - Heating Ventilating and Air Conditioning**

Shop Drawings  
As-Builts/Close-out O&M Manuals  
Coordination drawings  
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 - Matls						
Pumps - Labor						
Water Treatment - Matls						
Water Treatment - Labor						
Isolation - Matls						
Isolation - Labor						
Pipe Flex - Matls						
Pipe Flex - Labor						
Sheet Metal - Matls						
Sheet Metal - Labor						
Duct Insulation - Matls						
Duct Insulation - Labor						
Pipe Insulation - Matls						
Pipe Insulation - Labor						
Pipe, Valves, Fittings - Matls						
Pipe, Valves, Fittings - Labor						
Misc. - Labor						
Misc. - Matls						
Insulation - Matls						
Insulation - Labor						
Sanitary Above Slab - Matls						
Sanitary Above Slab - Labor						
Storm Above Slab - Labor						
Storm Above Slab - Matls						
Gas - Matls						
Gas - Labor						
Fixtures - Matls						
Fixtures - Labor						
Permits						
VAV Boxes - Matls						
VAV Boxes - Labor						
Refrigerant Monitor - Matls						
Refrigerant Monitor - Labor						
Unit Heaters - Matls						
Unit Heaters - Labor						
Startup						

**Controls**

Eng/Submittals						
Valves/Dampers - Matls						
Valves/Dampers - Labor						
Box Controls - Matls						
Box Controls - Labor						
Modules -Matls						
Modules -Labor						
End Devices - Matls						
End Devices - Labor						
Low Voltage Wiring - Matls						
Low Voltage Wiring - Labor						

Startup/commissioning  
Software Installation/Graphics upload to CFISD server  
Close-out Documents  
Training  
Punch List

**Div. 26 - Electrical**

Mobilization  
Shop Drawings  
As-Builts/Close-out/O&M Manuals  
Underground - Matls  
Underground - Labor  
Conduit -Matls  
Conduit - Labor  
Wire - Matls  
Wire - Labor  
Feeder Wire - Matls  
Feeder Wire -Labor  
Switches/Recpt. Matls  
Switches/Recpt. Labor  
Switchgear - Matls  
Switchgear - Labor  
Temporary - Matls  
Temporary - Labor  
Gas Generator - Matls  
Gas Generator - Labor  
Fixtures - Matls  
Fixtures - Labor  
Low Voltage - Engineering/Submittals  
Low Voltage Lighting- Devices - Matls  
Low Voltage Lighting- Devices - Labor  
Low Voltage Lighting - Wiring - Matls  
Low Voltage Lighting - Wiring - Labor  
Low Voltage Lighting - Programming/Start-up  
Low Voltage Lighting- Training  
Low Voltage Lighting - Close-out Documents  
Voice System - Wiring - Matls  
Voice System - Wiring - Labor  
Video System - Trim-out - Matls  
Video System - Trim-out - Labor  
Video System - Testing  
Master Clock - Matls  
Master Clock - Labor  
Close-out Documents  
Punch List  
Coordination Drawings

**Div. 27 - Communications**

Data System - Matls  
Data System - Labor  
Data System - Testing  
Communications/PA - Control Panels - Matls  
Communications/PA - Control Panels - Labor

**Div. 28 - Electronic Safety and Security**

Fire Alarm - Control Panel - Labor  
Fire Alarm - Wiring - Matls  
Fire Alarm - Wiring - Labor  
Fire Alarm - Devices - Matls  
Fire Alarm - Devices - Labor  
Fire Alarm - Testing  
Fire Alarm - Training  
Fire Alarm - Close-out Documents  
Security Systems - Submittals  
Security Systems - Devices - Matls  
Security Systems - Devices - Labor  
Security Systems - Wiring - Matls  
Security Systems - Wiring - Labor  
Security Systems - Cameras Matls  
Security Systems - Cameras Labor  
Security Systems - DVR Equipment - Matls  
Security Systems - DVR Equipment - Labor  
Security Systems - Programming/Start-up  
Security Systems - Training  
Security Systems - Close-out Docs.  
Video System - Close-out Docs

**Div. 31 - Earthwork**

Detention pond Final County inspection permit document  
Demolition (as applicable)  
Site Clearing & Grubbing  
Earthwork - Matls  
Earthwork - Labor  
Finish Grading Matls  
Finish Grading Labor  
Stabilization Matls  
Stabilization Labor  
Site Drainage - Matls  
Site Drainage - Labor

**Div. 32 - Exterior Improvements**

Chain Link Fence - Matls  
Chain Link Fence - Labor  
Paving - Matls  
Paving - Labor  
Sidewalks - Matls



	Sidewalks - Labor					
	Erosion Control - Matls					
	Erosion Control - Labor					
	Building Pad - Matls					
	Building Pad - Labor					
	Paving Subgrade					
	Signage/Striping					
	Bike Racks					
	Landscaping - Matls					
	Landscaping - Labor					
	Sod - Matls					
	Sod - Labor					
	Hydromulch - Matls					
	Hydromulch - Labor					
	Irrigation - Matls					
	Irrigation - Labor					
	Irrigation system testing/demonstration					
	<b>Div. 33 - Utilities</b>					
	Site Storm - Matls					
	Site Storm - Labor					
	Site Sanitary - Matls					
	Site Sanitary - Labor					
	U/G Fire Line - Matls					
	U/G Fire Line - Labor					
	Site Lighting - Matls					
	Site Lighting - Labor					
	Close-out Documents					
	Punch List					
	<b>Alternates</b>					
1						
2						
3						
4						
5						
	Allowances:					
	A. Owner's Betterment Allowance					

**General Note:** Close-out lists shall include As-builts, O&M's, Demonstration/Training, and any attic owner's stock.

**END OF SECTION**



## SECTION 01 31 13

### PROJECT COORDINATION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 - GENERAL

##### 1.1 REQUIREMENTS

- A. General: notify the Architect whenever there is need of clarification or interpretation of the Contract Documents prior to commencement of work.
- B. Commencement of work without Architect's prior notification means Contractor's acceptance of responsibility.
- C. Commencement of work without Architect's prior notification implies Contractor's understanding of conditions, assemblies, methods, or procedures.
- D. The project superintendent shall notify the Owner on an ongoing basis of ongoing work.

##### 1.2 PRE-INSTALLATION CONFERENCE

- A. General: Notify the Architect 48 hours in advance of certain stages of construction, and, as required by the Architect, organize a pre-installation meeting with each trade individually prior to commencement of their portion of the Work. At a minimum, representatives of the Architect, the General Contractor's project superintendent, and the Sub-contractor's Foreman and Project Manager shall be present at each meeting. The Engineer shall be notified as applicable.
- B. As indicated in each specific section of this Project Manual, or as required by the Architect, these stages generally include, but are not necessarily limited to the following:
  - 1. Division 2 - (Selective) Demolition.
  - 2. 05 50 00 - Miscellaneous metals, ladders, brackets, pipe rails, etc.
  - 3. Division 6 - Finish Carpentry and Millwork
  - 4. Division 7 - installation of waterproofing, vapor barriers, flashing and sheet metal.
  - 5. Division 7 - Installation of roofing system(s) and associated work.
  - 6. 07 21 00 - Concealment of insulation.
  - 7. Division 8 - Installation of doors, frames, windows, and storefronts.
  - 8. 08 71 00 - Installation of finish hardware
  - 9. Division 9 - Installation of plaster and gypsum board products.
  - 10. Division 9 - Installation of tile, flooring, and pavers.
  - 11. 09 51 00 - Installation of acoustical ceiling (grid and panels).
  - 12. 09 65 19 - Installation of resilient flooring and base.
  - 13. 09 91 00 - Painting and staining (each coat).
  - 14. Divisions 22, 23 and 26 - Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
  - 15. Division 23 - Installation of heating, ventilating and air conditioning.
  - 16. Division 26 - Installation of all electrical fixtures.
  - 17. Divisions 22, 23 and 26 - Any and all testing specified for equipment, mechanical, electrical and plumbing systems.
  - 18. 31 00 00 - Clearing and stripping of top soil within limits of grading.
  - 19. 31 00 00 - (Excavation and) Placing (of each lift of) select fill material, and site grading.
  - 20. 31 00 00, 31 23 23.13, and Divisions 22, 23 and 26 - Compaction, inspection, testing, and covering of underground utilities.
  - 21. Division 32 - Installation of site amenities, fencing, surfaces, landscaping, etc.

- C. In addition to notifying the Architect, notify the Structural Engineer (48 hours) prior to the following stages:
  - 1. Drilling, reinforcing, and placing of first piers and footings.
  - 2. Placing first reinforcing and grade beams.
  - 3. Erecting structural steel elements.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

### **3.1 PRE-CONSTRUCTION CONFERENCE**

- A. The Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction meeting with Contractor, Architect, and Owner. This meeting must occur prior to commencement of any construction.

### **3.2 CONFERENCES AND MEETINGS**

- A. Refer to Section 01 31 19, Project Meetings for requirements pertaining to Pre-construction Conference, Progress Meetings, and Pre-installation Conferences.

**END OF SECTION**

## **SECTION 01 31 19**

### **PROJECT MEETINGS**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 REQUIREMENTS INCLUDE**

- A. The Architect will:
  - 1. Schedule each meeting (pre-construction conference, periodic project meetings, pre-installation meetings, and specially called meetings throughout the progress of the work).
  - 2. Prepare agenda for meetings.
  - 3. Preside at meetings, including all significant proceedings and decisions.
  - 4. record, reproduce, and distribute copies of meeting minutes within seven (7) days, excluding weekends and holidays, after each meeting to:
    - a. All participants in the meeting.
    - b. All parties affected by decisions made at the meeting.
- B. The Contractor shall:
  - 1. Make physical arrangement for meetings.
  - 2. Participate in all meetings and conferences.
  - 3. Schedule attendance of Job Superintendent, Project Manager, and other parties affecting or affected by decisions made at meetings and conferences as their interests require.
  - 4. Provide updated schedules.
  - 5. Provide status reports/logs of RFIs, CPRs, MCs, and shop drawings/submittals.

#### **PART 2 - PRODUCTS**

Not Used

#### **PART 3 - EXECUTION**

##### **3.1 PRE-CONSTRUCTION CONFERENCE**

- A. Architect will:
  - 1. administer pre-construction conference for the establishment of communication methods, procedures and Owner requirements.
  - 2. administer site mobilization conference for clarification of Owner and Contractor.
- B. Location: At Project site or as designated by the Architect.
- C. Attendance:
  - 1. Contractor or Contractor's Representative
  - 2. Job Superintendent
  - 3. Project Manager
  - 4. Owner or Owner's Representative
  - 5. Major subcontractors
  - 6. Major suppliers
  - 7. Architect's Representative
  - 8. Consultants as needed
  - 9. Third-party Consultants
  - 10. Others as appropriate

- D. Meeting Agenda, may include, but is not limited to:
  - 1. Discussion on major subcontracts and suppliers and projected construction schedules.
  - 2. Critical work sequencing.
  - 3. Major equipment deliveries and priorities. Discussion of long lead time items.
  - 4. Project coordination and designation of responsible personnel.
  - 5. Procedures and processing of field decisions, proposal requests, requests for information (RFIs), submittals, minor changes, change orders and applications for payment.
  - 6. Method of distribution of contract documents.
  - 7. Procedures for maintaining record documents.
  - 8. Use of premises, office work and storage areas, on-site parking, and owner's requirements.
  - 9. Construction facilities and temporary utilities.
  - 10. Housekeeping procedures.
  - 11. Special owner requirements (specifications sections 01 35 23, 01 35 23.1 and 01 35 23.2)
  - 12. Lien release requirements

### **3.2 PRE-DEMOLITION CONFERENCE**

- A. Owner will:
  - 1. Administer pre-demolition conference for the establishment of communication methods related to demolition procedures and Owner coordination and scheduling requirements for demolition scope.
- B. Location: At Project site or as designated by the Architect.
- C. Attendance:
  - 1. Contractor or Contractor's Representative
  - 2. Job Superintendent
  - 3. Project Manager
  - 4. Owner or Owner's Representative
  - 5. Major Subcontractors
  - 6. Demolition Subcontractors
  - 7. Architect's Representative
  - 8. Consultants as needed
  - 9. Third-Party Consultants
  - 10. Others as appropriate
- D. Meeting Agenda, may include, but is not limited to:
  - 1. Discussion on projected demolition schedules.
  - 2. Procedures for coordination of demolition sequencing and scheduling.
  - 3. Procedures for coordination associated with existing building components need to be returned to Owner.
  - 4. Project demolition coordination and designation of responsible personnel.
  - 5. Procedures for maintaining record documents.
  - 6. Special owner requirements (specifications section 01 36 13).

### **3.3 PROGRESS MEETINGS**

- A. Architect will:
  - 1. Schedule project meetings throughout progress of the work at intervals to be determined.
  - 2. Set agenda and administer said meetings.
  - 3. Preside over meetings.
  - 4. Record meeting minutes, including all significant proceedings and decisions.
  - 5. Reproduce and distribute copies of meeting minutes within seven (7) days, excluding weekends and holidays, after each meeting to:
    - a. All participants in the meeting.
    - b. All parties affected by decisions made at the meeting.

- B. Contractor shall:
  - 1. Make physical arrangements for meetings.
- C. Attendance:
  - 1. Contractor or Contractor's Representative
  - 2. Job Superintendent
  - 3. Project Manager
  - 4. Owner or Owner's Representative
  - 5. Major subcontractors
  - 6. Architect's Representative
  - 7. Consultants as needed
  - 8. Others as appropriate
- D. Meeting Agenda, may include, but is not limited to:
  - 1. Review and approval of minutes of previous meeting.
  - 2. Review of work progress since previous meeting.
  - 3. Field observations, problems, and conflicts.
  - 4. Review of off-site fabrication and delivery schedules.
  - 5. Corrective measures and procedures to regain projected schedule.
  - 6. Review three week "look-ahead" construction schedule.
  - 7. Maintenance of quality standards.
  - 8. Response to request for information (RFIs) and status of outstanding RFIs.
  - 9. Status of submittals.
  - 10. Status of CPRs.
  - 11. Status of MCS.
  - 12. Other items and critical issues affecting work.

### 3.4 PRE-INSTALLATION CONFERENCES

- A. Architect will convene a pre-installation conference, when required in individual specification Section, prior to the Contractor commencing Work of the Section. The Contractor will produce agenda, Architect will distribute copies of the pre-installation conference minutes within seven (7) days, excluding weekends and holidays, after each conference to all participants in the meeting, the Owner and all parties affected by decisions made at the meeting.
- B. Attendance:
  - 1. Contractor's Superintendent(s)
  - 2. Subcontractor's Foreman
  - 3. Contractor's Project Manager(s)
  - 4. Architect's Representative
  - 5. Consultants as needed
  - 6. Owner or Owner's Representative
  - 7. Manufacturer's Representative
  - 8. Others affecting or affected by Work.
  - 9. Third party inspectors
- C. Meeting Agenda, may include, but is not limited to:
  - 1. Review of conditions of installation.
  - 2. Preparation and installation procedures.
  - 3. Coordinate with related work
  - 4. Review of the contract document requirements.
  - 5. Questions related to work required.
  - 6. Mockup samples or panels

### **3.5 MONTHLY PAY APPLICATION REVIEW MEETINGS**

- A. The Owner, Architect, and Contractor shall schedule and conduct monthly Pay Application review meetings during the entire duration of construction prior to the submission of the notarized completed Contractor Application for payment to the Architect for certification. The Contractor shall produce a draft of the proposed Application for Payment for review by the Owner and Architect. The Contractor shall include and furnish the following documents for review:
  - a. Draft of the Contractor's Application for Payment (AIA Document G702)
  - b. Invoices for any stored materials included in the Application. Invoices shall include full descriptions and costs as required to facilitate on-site review
  - c. Release of Liens from Subcontractors and Sub-subcontractors for all work billed in previous certified Applications for Payment.
  - d. Owner reserves the right to require Release of Liens for any previously submitted notice of claim submitted by any Subcontractor, Sub-subcontractor, or suppliers.
  - e. Evidence of payment for any and all backcharges, overtime, etc. previously issued by Owner that would be past due by the time payment is made by Owner.
  - f. Pay Application review checklists fully completed.
  - g. Updated project schedule
  - h. Owner may withhold payment on line items for which a lien or claim (or similar notice of intent) has been filed, until satisfactory release has been received and accepted by Owner.
- B. Attendance:
  - a. Owner's representative
  - b. Architect
  - c. Contractor
  - d. Subcontractors as appropriate
- C. Meeting agenda may include, but is not limited to:
  - a. Review percentages of work completed and being billed to date.
  - b. Review of any stored materials being billed to date and all associated surety recommendations
  - c. Review of lien releases, notices of claims, etc.
  - d. Confirmation of approved CPRs
- D. The meeting date shall be determined by the Architect, Contractor, and Owner, and shall occur on that same date each month.

### **3.6 SAMPLE MEETING AGENDA**

Refer to the following pages for a sample Pre-Construction Meeting agenda.

### **3.7 SUBMISSION OF FINALIZED APPLICATION FOR PAYMENT**

Refer to AIA Document A201<sup>TM</sup>-2017, as amended, Article 9.



***SAMPLE PRECONSTRUCTION MEETING AGENDA:***

**PROJECT NAME  
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT**

**CYPRESS-FAIRBANKS I.S.D. BID NUMBER:  
PRE-CONSTRUCTION CONFERENCE**

**AGENDA**

Date:

Time:

Location: Cypress-Fairbanks Independent School District  
Facilities and Construction Office  
11430 Perry Road  
Houston, Texas 77064

**I. INTRODUCTION OF PERSONNEL**

- |    |                        |                          |                |
|----|------------------------|--------------------------|----------------|
| A. | OWNER:                 | Cypress-Fairbanks I.S.D. | (281) 897-4108 |
| 1. | Name                   | Title                    | Phone Number   |
| B. | ARCHITECT:             |                          |                |
| 1. | Name                   | Title                    | Phone Number   |
| C. | CONTRACTOR:            |                          |                |
| 1. | Name                   | Title                    | Phone Number   |
| D. | THIRD PARTY INSPECTORS |                          |                |
| 1. | Name                   | Title                    | Phone Number   |

**II. REVIEW CONSTRUCTION GUIDELINE REQUIREMENTS**

**III. SUB/TRADE START-UP MEETINGS**

**IV. REVIEW CONSTRUCTION PROGRESS MEETING PROCEDURES**

**V. SPECIAL OWNER REQUIREMENTS**

**VI. DOCUMENTS MODIFYING AND/OR CLARIFYING THE CONTRACT**

- A. Minor Change Form
- B. Change Proposal Request Form
- C. Clarification
- D. Construction Change Directive
- E. Warranty Work Request
- F. Change Order Form
- G. Claims for additional time since last meeting (weather delays, etc.)

**VII. SCHEDULE, SITE OPERATIONS SET-UP AND MOBILIZATION**

**VIII. DISCUSSION**

**IX. LIEN RELEASE LOG AND BACKCHARGE LOG REVIEW**

**X. CLOSEOUT REQUIREMENTS**

**MEETING ADJOURNMENT**

**PROJECT:**

**CONSTRUCTION GUIDELINE REQUIREMENTS**

The Construction Guideline Requirements supplement the project documents and procedures established for the cooperation and coordination between the Contractor, Architect, and related activities scheduled throughout the construction project.

**I. RECORD DOCUMENTS AT JOB SITE**

- A. The Contractor shall maintain throughout the construction of the project a record set of documents at all times secured to the document table. These plans shall be updated to reflect any changes to the original drawings. Field clarifications, minor changes, addenda, and change orders are to be posted and/or noted on these drawings to document the actual project record conditions.
- B. The Contractor, at all times, shall maintain a record set of project specifications reflecting the information noted in Item 01.

**II. TESTING PROCEDURES**

- A. The Testing Laboratory shall be scheduled through the General Contractor to monitor the soils, concrete, rebar, structural steel, and other testing services required throughout the project. The General Contractor will be required to provide a 48-hour advanced notice to the testing laboratory for scheduled inspections.
- B. Concrete pours shall be scheduled by the General Contractor 48 hours in advance of the scheduled pour. The General Contractor will be responsible for scheduling both Architect's representative and the testing laboratory for observation and testing of the scheduled concrete pour. Unless prior approval has been arranged, all concrete pours are to be made in the presence of the testing laboratory and/or Architect's representative, following their review of all reinforcing steel and miscellaneous items.

**III. FIELD INSPECTIONS**

- A. Mechanical, Electrical, and Plumbing inspections shall be in compliance with the contract documents. Excavation, materials, installation, backfill, and cover-up shall be reviewed by a representative from Architect, the Owner, and/or an outside consultant in the required sequences for each scheduled activity. The General Contractor will be required to provide a 24-hour advance notice for each scheduled activity to be reviewed.

**IV. SUBMITTALS**

- A. Shop Drawings and/or submittals shall be submitted to the Architect in the required quantities (re: specs), with the Contractor's stamp affixed to all items and signed by the Contractor signifying he has reviewed each submittal and it meets exceeds all Contract requirements. Shop drawings or submittals not containing this information will be returned not approved. Commencement of work without reviewed and approved shop drawings will not be permitted. The Contractor will provide a list of shop drawings and/or submittals within 1 month of contract award noting the critical and/or priority items requiring immediate review and approval. Dates for submission of all items will also be provided. A complete set of shop drawings shall be maintained at the field office and their status reviewed at each construction progress meeting.

**V. CHANGES IN THE WORK**

- A. Change Requests involving additions, deletions, and/or revisions to the contract documents must be submitted by the Contractor to Architect's office in writing accompanied by an itemized material, labor, and equipment breakdown for review and approval prior to any changes occurring. Response to all minor changes and proposal requests must be submitted to Architect within 20 days for review and response.

**VI. LIST OF SUBCONTRACTORS**

- A. A list of each Subcontractor scheduled to perform work on the project should be submitted to Architect at the start of the project with Schedule of Values and before review of the first Application for Payment. (Use AIA Document G805)
- B. Prior to the commencement of work by each Subcontractor, a meeting will be scheduled to review the requirements, materials, and/or equipment specified in the contract documents.

**VII. SCHEDULE OF VALUES**

- A. The Schedule of Values shall be approved by Owner and Architect prior to submitting the first pay application. This Schedule shall include the monetary values for each item of construction, breaking out the labor and material for each activity. (Use AIA Documents G702 and G703)

**VIII. PROGRESS SCHEDULE**

- A. Progress Schedules shall be approved by Owner and Architect prior to submitting the first pay application. This schedule shall be a graphical projection of construction activities subdivided into various components and outlining the anticipated starting and completion dates. Indicate the "critical path" items and update the schedule monthly and recovery if required.

**IX. CONTRACTOR'S APPLICATION FOR PAYMENT**

- A. Pay applications will be reviewed monthly at the project site. The pay application will be in a preliminary draft for the review by Architect's and the Owner's representative. The reviewed, accepted, and/or modified pay application will be submitted to Architect's office for processing. Affected subcontractors and/or material suppliers are requested to be present at each pay application review. Progress schedules are to be revised and updated monthly and submitted with each preceding application for payment.
- B. Stored materials are required to be in accordance with Section 9.3.2.

**X. PROGRESS MEETINGS**

- A. Progress meetings will be held to discuss job progress, coordination, schedule, and anticipated conflicts. Those in attendance will be the Owner, Architect, General Contractor, affected subcontractors, and/or particular consultants. Frequency of the progress meetings will be determined by job conditions. The Architect will keep accurate minutes of the meetings and distribute copies to all in attendance.

**XI. LINES OF COMMUNICATION**

- A. The Architect is the Owner's representative and all communications between the Owner and General Contractor shall be channeled through the Architect. Subcontractors shall correspond with the Owner and/or the Architect through, or in the presence of, the General Contractor.
- B. The Superintendent shall be fully knowledgeable of the contract documents. Review and approval by the Superintendent of all items prior to observations by the Architect and/or Owner's representative is essential in avoiding project delays and re-inspection of nonconforming work.

**XII. ADDITIONAL SERVICES**

- A. Additional architectural or engineering services and testing or retesting to analyze and inspect nonconforming work shall be at the Contractor's expense.

**XIII. APPROPRIATE CONDUCT**

- A. Appropriate conduct and language must be exercised by all construction workers. Appropriate clothing must be worn at the job sites by all workers. Misconduct involving a worker will constitute immediate dismissal and removal of said worker from the project site.
- B. The Contractor shall comply with all Special Owner Requirements per Specification Section 01 35 23 herewithin.

**XIV. SUBSTITUTIONS**

- A. Substitutions not approved prior to proposal will not be considered.

**XV. SUBSTANTIAL COMPLETION AND CLOSE OUT**

- A. The General Contractor shall submit in written form a list of items requiring completion (per contract requirement) and/or correction along with a written request for substantial completion.
- B. The General Contractor shall submit all of the required documents, information, and materials to the Architect to expedite project close-out as outlined in the Project Close-Out Specifications.

**PROJECT:**

**CONSTRUCTION TRADE START-UP MEETING GUIDELINES**

The Architect shall direct the General Contractor to arrange a time and location 48 hours prior to a new trade commencing work for the purpose of reviewing and discussing the project documents and specifications governing the particular Subcontractor's work.

The reviews should include, but not be limited to, the following:

1. Determine if all appropriate shop drawings, samples, and/or literature has been submitted, reviewed, and approved.
2. Determine if the Subcontractor has all the current documents to begin and complete his work in compliance with the contract.
3. Inform the Subcontractor/Foreman that if inspections will be needed, the Contractor must provide the Architect with a 48-hour advance notice.
4. Review with the Contractor and Subcontractor any storage or temporary staging areas required and whether there will be conflicts with other trades.
5. Determine if Subcontractor/Foreman has knowledge of what area his work will commence and the sequence to be followed.
6. Examine thoroughly each part and section of the specifications, noting materials, workmanship, manufacturer's recommendations, installation, etc.
7. Alert the Contractor and Subcontractor to special conditions outlined in the project documents and/or project specifications required by the Architect, Owner, or related Consultants.
8. Emphasize that clean-up is a very important item in the overall construction of the project and that an unsightly project will not be tolerated.
9. Inquire if there are any questions relating to the specific areas covered or questions about areas not specifically covered.
10. Review coordination drawings required by Contract.

**PROJECT:**

**JOB PROGRESS MEETING GUIDELINES**

The Architect shall consult with the Owner's representative to determine at what intervals progress meetings will occur. The Architect shall inform the General Contractor of the time, date, and locations of the Construction Progress Meetings and the regularity of the proposed scheduled meetings.

**ARCHITECT**

1. The Architect shall prepare a Record of Attendance sign-in sheet for those attending the progress meeting.
2. The Architect shall preside over the order of the meeting. The Architect shall then recognize the General Contractor's representative, who will address the items outlined under the Contractor.
3. Following the completion of the Contractor's agenda, comments will be received and/or offered by the Owner, Architect, Contractor, and any member in attendance at the progress meetings.
4. The Architect shall submit to the Owner and Contractor notes describing the accounts of the progress meeting, including the time, date, and location of the next scheduled meeting.
5. The Architect, upon reviewing the previous meeting minutes with the Owner and General Contractor, shall amend, add to, or accept as submitted. The meeting notes will then be mailed to the Owner and Contractor for their record copy of the accepted meeting notes.

**CONTRACTOR**

1. The Contractor, at the beginning of each progress meeting, shall submit an agenda outlining those scheduled to attend, an updated progress schedule, and any other matters of interest requiring discussions and/or immediate response affecting the overall construction progress.
2. The progress meetings shall be attended by the Project Manager, Field Superintendent, representatives from trades in progress or trades to begin work prior to the next scheduled meeting. Materials suppliers and/or other representatives impacting the current or near-current construction schedule shall also be in attendance.
3. The Contractor shall review and update the construction schedule by noting progress, work in progress, and anticipated work to begin. Areas of delays in deliveries, materials, equipment, manpower, utilities, pending architectural responses, and/or pending Owner responses that may affect the construction progress shall be addressed in conjunction with the construction progress schedule.

**END OF SECTION**

## SECTION 01 31 29

### NOTIFICATION OF ARCHITECT REQUIREMENTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 - GENERAL

##### 1.1 REQUIREMENTS

- A. In general, the Contractor shall notify the Architect whenever there is need of clarification of interpretation of the Contract Documents.
- B. The Contractor shall notify the Architect 48 hours in advance of certain stages of construction. The project superintendent shall notify the Owner's Representative on an ongoing basis of ongoing work. These stages shall include, but are not necessarily be limited to the following:
  - 1. Division 2, Division 31 - Clearing of site.
  - 2. Div 31-33 - Stripping of top soil within limits of grading.
  - 3. Div 31-33 - (Excavation and) Placing (of each lift of) select fill material.
  - 4. Div 31-33 - Compaction, inspection, testing, and covering of underground utilities.
  - 5. 31 63 29 - Drilled and reamed foundation piers.
  - 6. 31 23 00 - Excavation of grade beams.
  - 7. 03 30 00, 04 22 13 - Placing of concrete.
  - 8. 07 81 00 - Concealment of insulation.
  - 9. 07 84 00 - Installation of firestopping and firesafing.
  - 10. 07 52 19 - Modified Bitumen Membrane Roofing System
  - 11. 07 92 00 - Installation of building and glazing sealants.
  - 12. 08 80 00 - Installation of glazing and glazed systems.
  - 13. 09 21 16 - Installation of gypsum wallboard.
  - 14. 09 30 13 - Installation of ceramic tile.
  - 15. 09 51 00 - Installation of acoustical ceiling (grid and panels).
  - 16. 09 65 19 - Installation of resilient flooring and base.
  - 17. 09 68 00 - Installation of carpeting.
  - 18. Division 09 - Painting and staining (each coat), Elastomeric coatings, etc.
  - 19. Division 02 - Abatement work
  - 20. Division 23 - Installation of heating, ventilating and air conditioning system.
  - 21. Division 23 - HVAC system startup
  - 22. Division 22 - Installation of plumbing fixtures.
  - 23. Divisions 21-26 - Any and all testing and training specified for equipment, mechanical, electrical and plumbing systems.
  - 24. Divisions 21-26 - Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
  - 25. Division 26 - Initiation of permanent power
  - 26. Division 26 - Installation of all electrical fixtures.
  - 27. Division 27-28 - Installation of all data, low voltage, security, special systems, fire alarm, and misc. technology systems.
  - 28. Notify the Architect and the Owner: All pre-construction or trade startup meetings.
  - 29. Owner shall be given notification/opportunity to conduct inspections prior to wall or ceiling cover up.
- C. In addition to notifying the Architect, the Contractor shall also notify the Structural Engineer (48 hours) prior to the following stages:
  - 1. Drilling, reinforcing, and placing of first piers and footings.
  - 2. Placing first reinforcing and grade beams.
  - 3. Erecting structural steel elements.

- D. Above ceiling inspections shall be completed prior to cover up. All systems are to be reviewed at the same inspection. All systems shall be 100 percent complete prior to inspection.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

### **3.1 PRE-CONSTRUCTION CONFERENCE**

- A. The Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction and/or trade startups meeting with Contractor, Architect, Owner, and third-party firms. This meeting must occur prior to commencement of any construction.

### **3.2 CONFERENCES AND MEETINGS**

- A. Refer to Section 01 31 19, Project Meetings for requirements pertaining to Pre-construction Conference, Progress Meetings, and Pre-installation Conferences.

**END OF SECTION**



## **SECTION 01 32 16**

### **CONSTRUCTION PROGRESS SCHEDULE**

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Refer to Instructions to Proposers for substitutions.

##### **1.2 SUBMITTALS**

- A. Schedules:
  - 1. Preliminary Analysis: Within fourteen days after receipt of Notice to Proceed, submit a preliminary construction schedule for review.
  - 2. Construction Schedule: Within four weeks after receipt of Notice to Proceed, submit one reproducible and four prints of the construction schedule.

##### **1.3 RELIANCE UPON SCHEDULE**

- A. The construction schedule as approved by the Architect will be an integral part of the Contract, and will establish conditions for various activities and phases of construction.

#### **PART 2 - PRODUCTS**

##### **2.1 CONSTRUCTION SCHEDULE**

- A. Diagram: Graphically show the order of all activities necessary to complete the work and the sequence in which each activity is to be accomplished.
- B. General Requirement:
  - 1. Contractor shall provide a completed Project Schedule as outlined below 14 days after Contract Award for review and comment by Owner and Architect
  - 2. Activities shown on the schedule shall include, but not necessarily be limited to:
    - a. Project mobilization.
    - b. Submittals and approvals of shop drawings and samples.
    - c. Phasing of construction.
    - d. Procurement of equipment and critical materials.
    - e. Fabrication and installation of special material and equipment.
    - f. Final clean-up.
    - g. Final inspection and testing.
    - h. Air and water balancing.
    - i. Demonstrations for Owner and Owner's staff.
    - j. Punch lists.
    - k. Project closeout.
    - l. Commissioning Schedule
  - 3. The project Schedule shall be divided by trade/spec section and by area of the building with each section to include such items as material delivery dates, below-grade finish/install, above-grade finish/install, trimout, etc. Detail to include specific components of the trade being scheduled (for example: painting would show clean/prep. Block fill, first coat, finish coat, etc.).
  - 4. Project Schedule shall include the amount of anticipated weather days allocated for the Project at the appropriate months, and should also include such milestones as permanent power, chiller startup, etc. where applicable.

5. Contractor shall complete the subcontract trades buyout process 30 days after the Contract award.
6. Contractor shall ensure that all required submittals are submitted for review no later than 60 days after Contract award.
7. Project schedule shall be initially scheduled to allow Initial Completion 60 days prior to Substantial Completion. The 60-day period between Initial Completion and Substantial Completion shall be allocated for such items as the following:
  - a) *Initial Final Clean*
  - b) *Trial owner's systems testing*
  - c) *Owner's tests and inspections*
  - d) *Owner's systems demonstrations*
  - e) *Establishment of required stand of grass*
  - f) *Correction of Contractor's punch list*
  - g) *Owner/Architect punch list*
  - h) *Correction of Owner/Architect punch list*
  - i) *Final clean to deliver building after all tests and inspections*
  - j) *Substantial Completion*
  - k) *Test and Balancing*
  - l) *Commissioning*
8. Schedule shall also include a review of O&M manuals 30 days prior to Substantial Completion and shall include submission of a closeout document binder mock-up.

## 2.2 CONSTRUCTION SCHEDULE LIMITATIONS

- A. Work performed under this Contract shall be performed in accordance with the following paragraphs so that the Owner can accept the project as substantially complete as noted below.
- B. The project schedule begins upon Notice to Proceed and continue uninterrupted with the following requirements:
  1. The entire project shall be substantially complete by dates noted in the Standard Form of Agreement between Owner and Contractor (AIA Document A101™-2017, as amended) subject to Liquidated Damages as listed in General Conditions of the Contract for Construction as amended (AIA Document A201™-2017, as amended) and Supplemental Conditions (Section CB).
- C. Certificates of Substantial Completion may be issued for any of the above mentioned areas of work which are complete prior to the completion of the entire project, provided that all contract requirements for Substantial Completion are met for that portion of the Work. However, warranties shall commence on date of Substantial Completion of entire project. Maintenance required by equipment manufacturers shall be performed by Contractor through the agreed-upon Substantial Completion date, unless specified otherwise in the Contract Documents.
- D. For work during Summer: Any construction related activities after (Last Day of School) and before the start of the next school year, must occur during CFISD normal working hours of Monday through Thursday (10-hour days) or the contractor must request and pay for overtime request to have the building open per Special Owner Requirements Section 01 35 21.1. This requirement will also apply to any work during the school year outside the normal CFISD working hours. The 4-day/10-hour day schedule will only be applicable during scheduled summer break.

**END OF SECTION**

SECTION 01 32 23

SURVEY AND LAYOUT DATA

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 QUALITY CONTROL

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

1.2 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit name, address, and telephone number of Surveyor to Owner's Representative before starting survey work.
- C. Submit documentation verifying accuracy of survey work on request.
- D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contract.

1.3 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.
- B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.
- C. Submit record documents under provisions of Division 1.

1.4 EXAMINATION

- A. Verify locations of survey control points prior to starting the Work.
- B. Notify Owner's Representative immediately if any discrepancies are discovered.

1.5 SURVEY REFERENCE POINTS

- A. The Owner will establish survey control datum as indicated on Drawings. Inform Owner's Representative in advance of time additional horizontal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to the Owner or Contractor.
- B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.
- C. Notify Owner's Representative a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.
- D. Promptly report loss or destruction of reference points to Owner's Representative.
- E. Reimburse the Owner for cost of reestablishment of permanent reference points disturbed by construction operations.

- 1.6        SURVEY REQUIREMENTS.
- A.        Utilize recognized engineering survey practices.

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

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

1.        Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs.

2.        Grid or axis for structures.

3.        Building foundation, column locations, and ground floor elevations.

D.        Periodically verify layouts.

PART 2        P R O D U C T S - Not Used

PART 3        E X E C U T I O N - Not Used

END OF SECTION

## **SECTION 01 33 00**

### **SUBMITTALS**

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Refer to Section AB for substitutions.

##### **1.2 PROCEDURES**

- A. Transmit each item with approved form identifying project, contractor, subcontractor, major supplier; identify pertinent drawing sheet and detail number and specification section number, as appropriate. Identify deviations from Contract Documents.
- B. Apply Contractor's stamp, signed, to each item submitted, certifying that review and verification of products, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the work and Contract Documents.
- C. Revise and resubmit submittal as required; identify all changes made since previous submittal.
- D. After review, distribute copies to all concerned parties.

##### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- A. Refer to AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended, 3.12.13 for the number of copies required. Transmit Consultant and Engineering submittals directly to respective consultants with a transmittal to the Architect.
- B. The Contractor shall provide composite drawings within 4 weeks of Notice To Proceed, showing how all piping, ductwork, lights, conduit, and 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 1/4 inch per foot minimum scale and shall include invert elevations and sections required to meet the intended purpose.
- C. Manufacturer's Instructions: When work is specified to comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Architect at least two weeks prior to start of such work.
- D. All dimensions indicated on the drawings are based on the specific models and manufacturers of products, equipment, fixtures, and miscellaneous items specified. If the Contractor uses an approved product by another listed manufacturer which is different than the specific model and manufacturer listed in these specifications, then the Contractor shall be solely responsible for the coordination of any dimensional changes required, including structural, relocation of walls, equipment, fixtures, ceilings, and miscellaneous items. When dimensional changes are required in these situations, the Contractor shall submit a proposed modification drawing to the Architect for approval prior to proceeding with the work. All causes and effects of the dimensional change shall be indicated on the Contractor's drawing submittal.

##### **1.4 SAMPLES**

- A. Submit full range of manufacturer's standard colors, textures, and patterns for Architect's selection. Submit samples for selection of finishes in accordance with approved schedule, and in such sequence as to cause no delay in the work or in the work of any other Contractor. All color samples to be physical samples, not digital unless requested by Architect.

- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.
- C. Submittals shall contain:
  - 1. Date of submission and dates of any previous submissions
  - 2. Project title and number
  - 3. Contract identification
  - 4. Names of Contractor, Supplier, Manufacturer
  - 5. Identification of sample, with specification section number
  - 6. Note any deviation from contract documents
- D. Resubmission Requirements for Samples:
  - 1. Make any corrections or changes in the submittals required by the Architect and resubmit until approved.
  - 2. Submit new samples as required for initial submittal.
- E. Submit the number specified in the respective Specification section; minimum of two, one will be retained by Architect. Reviewed samples may be used in the work if so indicated in the specification section.

## **2. MANUFACTURER'S CERTIFICATES AND WARRANTIES**

- A. Submit required certificates and warranties in duplicate.

**END OF SECTION**

## SECTION 01 35 23

### SPECIAL OWNER REQUIREMENTS

This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign this document and an original, notarized copy will be attached to the Construction Contract.

1. **Substantial Completion: Refer to the General Conditions of the Contract for Construction as amended, Paragraph 9.8.**
2. **Documentation of Existing Conditions**
  - a. Conditions of improvements (roads, landscape areas, signage, building exterior and interior, etc.) at the building site where work is scheduled to occur are considered to be in good condition. The Contractor shall document through the use of digital video, any existing defects in areas where work will actually be performed, including but not limited to, staging areas and areas of circulation around the site, prior to the start of any construction. Contractor shall also test and document building and site systems (fire alarm, sound, irrigation, etc.) These systems are considered to be in good operating condition unless documented otherwise. A copy of all digital video (flash drive) must be filed with the Owner prior to the start of any construction. Any and all defects not specifically identified prior to construction shall be repaired/replaced by the contractor to the satisfaction of the Owner, at no additional cost.
3. **Application for Payment:**
  - a. Pay application(s) must be correctly completed and executed by the Contractor. All numerical columns and tabulations should be correctly totaled to the nearest cent. With each pay application, Contractor shall also submit partial lien releases from all sub-contractors and major suppliers on the form included in this Project Manual, for work performed through the previous accounting period, an updated construction schedule and construction progress photographs. All lien notices received by the Owner from the previous pay period must be cleared by submission of an unconditional release of lien prior to submission and approval of current applications for payment. Noncompliance with these requirements will result in the return of the Application for Payment(s) to the Contractor for correction and resubmittal. Final application for payment shall only be submitted to the Owner upon completion of all close out requirements including but not limited to receipt of Record Documents, Operation and Maintenance Manuals, Owner Orientation and Training Meetings, Consent of Surety, Contractor Final Release of Lien, Contractor's Affidavit of Payment of Debts and Claims, and unconditional final lien releases from all subcontractors, sub-subcontractors and major suppliers and any other closeout requirements per the contract documents.
  - b. **If errors are discovered by the Owner in certified applications for payment, the Owner shall reject the application and return it to the contractor for correction. The specified time period for payment of such applications will start over on the date the Owner receives the corrected certified application for payment from the Architect.**
4. **Construction Schedule:**
  - a. Refer to Section 01 32 16. The Contractor shall provide a detailed construction schedule at the start of the project and shall submit an updated schedule at the weekly construction meetings. This schedule will also identify the estimated percentage of work completed to date for each item of work along with percentage of work remaining to be completed. This information will be used in the verification of the Contractor's Application for Payment. Application for Payment will not be reviewed, approved, and processed without submittal of the initial schedule and subsequent updated schedules throughout the duration of the project.

**5. Use of Alcohol and Tobacco Products:**

- a. Smoking and the use of all tobacco and alcohol products are prohibited at all times on Cypress-Fairbanks ISD property, including the field office. The Contractor will be fined \$250.00 for each infraction of this policy. In addition, the Owner reserves the right to have the Contractor's personnel dismissed from the District property. This policy is strictly enforced by all employees of Cypress-Fairbanks ISD.

**6. Reinspection Fees:**

- a. During the course of the project, should additional inspections be required by the Owner or Consultants to review problems directly created by and attributable to the Contractor, then all associated expenses including mileage shall be deducted from funds remaining to be paid to the Contractor. The Owner or Architect will verbally inform the General Contractor of the intent to request additional reinspection fees at the time of the occurrence and will provide written invoicing within thirty (30) working days after the date of the occurrence.

**7. Job Superintendent:**

- a. The Contractor will be required to keep the job superintendent on the job site full-time during the course of the job until completion of all punch list items. In the event the job superintendent is absent from the job site at any time during the project contract time or during punch list completion and a previously agreed upon substitute is not provided, the Owner may fine the Contractor \$250.00 per occurrence.
- b. The Owner is to be notified at the beginning of the workday if the job superintendent is out sick. If the superintendent is out for any other reason, the Owner is to be notified at least twenty-four (24) hours in advance. In both cases, the Owner is to be informed of the name of the acting job superintendent.
- c. Subcontractors, Sub-subcontractors are not allowed to work unsupervised on the jobsite at any time during the performance of the work including overtime and weekends.
- d. Where multiple sites are part of the construction contract, the Contractor shall furnish a full-time superintendent for each project campus work is to be performed unless otherwise specified or agreed to by the Owner.

**8. Site/Building Rules and Regulations**

- a. The Contractor shall adhere to the following building rules and regulations during the performance of the work within this contract. The Owner will back charge the Contractor in the amount of \$250.00 per occurrence for any violations of any of these rules and regulations. In addition, the Owner reserves the right to remove the person committing the violation permanently from the project site.
  1. No foul language or spitting will be allowed on district property and within the interior of the buildings.
  2. The possession of tobacco products, firearms, alcohol, or illegal drugs is strictly prohibited on school property and is a state and federal law and subject to criminal charges for any such violation.
  3. Workers must be fully clothed. Shorts and tank tops are not allowed on school property.
  4. The Contractor's personnel shall demonstrate professional behavior and respect toward all school district personnel and property. Physical, verbal, or visual contact with students is strictly prohibited.
  5. Any worker with a history of felony convictions or warrants is strictly prohibited from working on district property. The District has the right to perform criminal checks on any worker the Contractor and/or its subcontractors proposes to use on the project prior to



- issuance of security identification badges. The Owner reserves the right to check such records anytime during construction if the Owner deems it necessary for the safety and protection of the students and staff.
6. The Contractor's personnel are not allowed to park on any grass area, under shade trees, sidewalks, or non-vehicular paved areas. The Contractor will be held liable for any resultant damages resulting from the violation of this requirement.
  7. Authorization must be obtained in advance with the campus administrator or the Facilities Planning and Construction Department to enter or access any existing facility campus.
  8. The Contractor, subcontractors or sub-subcontractors shall keep the premises and site free from accumulation of waste, materials or rubbish caused by the work under this contract at each site. Boxes must be broken down prior to removal from the building. Upon completion of the contract work, and prior to the final inspection, have the premises in a neat and clean condition.
  9. The Contractor shall take all precautions necessary for the safety of, and provide protection to prevent damage, injury or loss to:
    - a. All employees on the project and all other persons who may be affected thereby.
    - b. All the work with all the materials to be incorporated therein, whether in storage on or off the site.
    - c. All property at the site and adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and any other school property.
  10. A competent supervisor who understands the full scope of the work shall be on-site at all times while work is being performed and remain on-site until all punch list items have been completed as specified here within this specification section.
  11. The Contractor shall be responsible to Cypress-Fairbanks I.S.D. for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the work under the contract.
  12. The Contractor shall not perform any work within the confines of a secured building on a renovation/addition project or after Substantial Completion on a new Project without the District having one District custodian present during performance of the work. The contractor must reimburse Cypress-Fairbanks I.S.D. Operations Department for the overtime costs associated with the after-hours work as specified within this specification section. Refer to Special Owner Requirements Overtime Section 01 35 23.1.
  13. All exterior doors must be kept closed at all times.
  14. All workers must wear badges at all times when on CFISD property. Refer to Special Owner Requirements Badging Section 01 35 23.2
  15. All deliveries shall be received and signed for by the Contractor and not by Cypress-Fairbanks ISD personnel. The Contractor shall post signs, in a location agreed upon by the Owner's Representative, stating where deliveries are to be received and who is to sign for them.

Signature form follows on next page.

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

Respectively Submitted,

By:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City, State, Zip Code

(Seal - if Proposer is a Corporation)

Date \_\_\_\_\_ State of \_\_\_\_\_ County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_

Notary Public:

My Commission expires:

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

**END OF SECTION**

**SECTION 01 35 23.1**

**BUILDING OVERTIME REQUESTS  
SPECIAL OWNER REQUIREMENTS**

This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign this document and an original, notarized copy will be attached to the Construction Contract.

**Contractor Overtime and Building Access**

- A. Owner's building personnel will be present at all times during the performance of the Work by the Contractor should Work be necessary during non-normal hours, weekend, School District employee Holidays and after the date of substantial completion. If the Contractor needs access to the sites other than normal campus working hours, notification shall be provided to the Owner's Representative through the Facilities Planning and Construction Office Project Manager. The attached "Contractor Overtime Building Access Request Form" within this section shall be submitted for all overtime requests to obtain Owner approval.
- B. Overtime requests/scheduling: Contractor shall request with the attached form and submit by noon, a minimum of three (3) days in advance of the anticipated Work an overtime request. These requests shall be a minimum of four (4) hour charge. If Contractor does not work the entire time of requested overtime hours, the Contractor will still be responsible for paying the total requested overtime hours billing. With each request, Contractor will be billed 30 minutes to allow Operations to open and secure the building as well as 30 minutes for lunch.
- C. The Contractor shall compensate the Owner at the rate of twenty-two (\$22.00) dollars per hour for non-normal and weekend hours, and thirty-three (\$33.00) dollars per hour for School District employee Holidays.
- D. Overtime cancellations: Contractor shall request and submit by noon, a minimum of two (2) days in advance of the anticipated Work an overtime cancellation request should scheduled work and overtime not occur. If Contractor fails to cancel, they will be charged the four (4) hour minimum charge.
- E. Invoices will be submitted by the Owner to the Contractor on a monthly basis and are payable upon receipt to Cypress-Fairbanks I.S.D. Operations Department. Payment must be received within thirty (30) days of the invoice date. Owner reserves the right to refuse future overtime requests as well as the rejection of any current application for payment until such time outstanding payments are received.
- F. Hours:
  - 1. Normal School hours: 6:30 AM – 11:30 PM Monday – Friday
  - 2. Summer hours: 6:00 AM – 4:30 PM Monday - Thursday
  - 3. Not including District recognized employee Holidays per academic year calendars on District's website: Spring Break Week, Thanksgiving Week and Winter Break  
6:00 AM – 2:30 PM
  - 4. Food Production, school kitchens:

Elementary	7:00 AM – 3:30 PM for most, verify with Owner
Middle	6:30 AM – 3:00 PM for most, verify with Owner
High	6:00 AM – 2:30 PM for most, verify with Owner
- G. Package renovation and construction projects containing multiple district campuses will require overtime requests/cancellations be submitted for each building as needed.
- H. Overtime agreements made that differ from the above noted guidelines will not be accepted or honored.
- I. For site work only, the Contractor is required to complete the overtime form and submit it to the District. There will be no charge for site work only to the Contractor. The District will notify all parties to inform them work is being scheduled to be performed on our site.

Signature page continued below.

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

Respectively Submitted,

By:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
City, State, Zip Code

(Seal - if Proposer is a Corporation)

Date \_\_\_\_\_ State of \_\_\_\_\_ County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_

Notary Public:

My Commission expires:

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

**CONTRACTOR  
OVERTIME / BUILDING ACCESS REQUEST FORM  
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT**

<b><u>CONTRACTOR:</u></b>	<b><u>CYPRESS-FAIRBANKS ISD USE ONLY:</u></b>
1. Date of Request: _____	1. Total Overtime Hours Requested: _____
2. Project: _____	2. Total Overtime Amount Due Cy-Fair ISD: _____
3. CFISD Project Number: _____	3. Date Submitted to Operations: _____
4. Campus: _____	4. Date Submitted to Security: _____
5. Requested Date: _____	5. Date Submitted to Facilities Use: _____
6. Requested Hours: _____ (Minimum 4 hours must be requested)	6. Comments:
7. General Contractor/Subcontractors Working and contact mobile phone numbers:  _____ _____	
8. Project Manager and Superintendent's Name and contact mobile phone numbers:  _____ _____	
9. Requested By: _____	

On a monthly basis and prior to contract closeout and final payment by the Owner, the Contractor hereby agrees to reimburse Cypress-Fairbanks ISD the amount of twenty two (\$22.00) dollars per hour for non-normal days & weekend hours and thirty three (\$33.00) dollars per hour for School District employee Holidays for the above requested overtime hours. Reimbursement will be made by separate check made payable to the Cypress-Fairbanks ISD Operations Department within thirty (30) days of invoice date. If Contractor does not work the entire time of requested overtime hours, the Contractor will still be responsible for the total requested overtime hours. With each request, Contractor will be billed 30 minutes to allow Operations to open and secure the building and also includes 30 minutes for lunch.

Acknowledged and Agreed to by:

\_\_\_\_\_  
Contractor's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

Approved by:

\_\_\_\_\_  
CFISD Project Manager's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name

**END OF SECTION**



## Section 01 35 23.2

### Special Owner Requirements - Badging Process

For Contractors, Sub-Contractors, Service Providers, & Vendors

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 - GENERAL

Refer to enclosed instructions and Form AP packet for necessary submission information and procedures.

##### 1.1 SECTION INCLUDES

- A. This Section has been added to identify and reinforce specific items that are currently defined in depth in the specifications, and that are of great importance to Cypress-Fairbanks Independent School District. The Owner of the Construction Company making an offer on the project must sign these documents and an original, notarized copy will be attached to the Construction Contract.
- B. Mandatory photo identification badge with the workers name and name of the Construction Company, which shall be worn at all times *[required after Substantial Completion for new buildings; required at all times for renovations]* shall be provided by the Owner and payable by the General Contractor. The General Contractor shall provide a list of all employees, suppliers, etc., that will be on the job site for more than 1 hour per day. The Owner reserves the right to reject issuing a security badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker not wearing proper identification, from the project site. Back charges are applicable for any infraction of this requirement.
- C. Lists must be forwarded to the Facilities Planning & Construction Department 72 hours or earlier in advance of going to the site.
- D. List shall be submitted on forms contained in Form AP packet.
- E. Should a Contractor want to add names to their original list, they must be added on a separate list.
- F. A maximum of 5 groups of **3-4 workers** may report to the Facilities Planning and Construction Department to have photos taken and pick-up the identification badges, based upon the agreed upon schedule. If more than the maximum number of workers show up, they will be asked to wait, or to return at a later time.
- G. Badges will include the General Contractor, Subcontractor or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will typically be 6 months after the scheduled contract substantial completion date, but not longer than one year from date of issuance. Upon expiration, the contractor shall repeat the application process. There is no charge for renewal badges provided that the worker returns his previous badge. Otherwise, the \$10.00 charge applies.
- H. Badges must be worn at all times by all General Contractor, Subcontractor or Sub-subcontractor personnel on school district property during the construction of the project.
- I. The Contractor will be invoiced by Facilities Planning, & Construction and will be responsible for payment within 30 days of the invoice date.
- J. Should a person lose a badge and need a replacement, this procedure will be used to obtain the replacement badge. A \$10.00 charge for the replacement badge will be applicable for all lost badges.
- K. The Contractor shall contact Facilities Planning, & Construction with any questions during the process. The Contractor shall not contact Cypress-Fairbanks Police Department directly.

- L. Contractor shall return all project badges to CFISD. This included but is not limited to the Contractor, Sub-contractor, sub-sub-contractor, etc. Should badges not be returnable, Contractor shall submit letter in writing noting badges are lost for CFISD records as well as be assessed a fee of \$10.00 for each badge not returned to CFISD. If Contractor fails to pay such fees, the Owner will deduct such charges from the final payment.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

- 3.1 Refer to and follow the attached instructions.

**END OF SECTION**



## **SECTION 01 36 13**

### **RENOVATION PROJECT PROCEDURES**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 REQUIREMENTS INCLUDED**

- A. This Section contains general provisions and requirements pertaining to all remodeling, removal, and relocation of Work in the existing building and becomes a part of each Section and Division performing remodeling, removal and relocation Work for this Project with the same force and effect as if written in full therein.
- B. Take all necessary precautions to keep students and other trespassers out of the Work areas. Secure Work areas from entry when Work is not in progress.
- C. Perform all alterations, remodeling, demolition, removal and relocation of Work in strict accordance with Owner's instructions and applicable Federal, State and local health and safety standards, codes and ordinances. Where conflicts occur, the more restrictive requirement shall govern.
- D. Refer to section 01 71 50 Preventive Housekeeping and Final Carpet Cleaning.

##### **1.2 RELATED WORK**

- A. Section 02 41 01 - Demolition

##### **1.3 EXISTING CONDITIONS**

- A. Obvious existing conditions, installations and obstructions affecting the Work shall be taken into consideration as necessary Work to be done, the same as though they were completely shown or described.
- B. Items of existing construction indicated to remain upon completion of the Contract, but which require removal to complete the Work, shall be carefully removed and replaced as required. The replaced Work shall match its condition at the start of the Work unless otherwise required.
- C. Visit the site to determine by inspection all existing conditions, including access to the site, the nature of structures, objects and materials to be encountered, and all other facts concerning or affecting the Work. Information on the Drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered.
- D. Utilities: Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the Architect/Owner in writing two (2) weeks in advance. Provide temporary services during interruptions to existing utilities.

#### **PART 2 - PRODUCTS**

##### **2.1 SALVAGED MATERIALS**

- A. The Owner reserves the right of first refusal on all salvage items. Remove remaining items from the site as Work progresses. Storage or sale of items on site is not permitted. Burning or burying of removed materials on site is not permitted.
- B. Store salvaged items in a dry, secure place on site.

- C. Salvaged items not required for use in repair of existing Work shall remain the property of the Owner.
- D. Do not incorporate salvaged or used material in new construction except where specified in the Contract Documents

## **2.2 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING**

- A. Contract Documents do not define products or standards of workmanship present in existing construction. Determine products by inspection and by use of the existing. Provide same or similar quality products or types of construction as that in existing structure when needed to patch or extend existing Work.
- B. If reasonably matching products are not obtainable, improve appearance by minor relocating of some existing products and grouping new ones in some pattern arranged by the Architect.

## **PART 3 - EXECUTION**

### **3.1 PROTECTION OF WORK TO REMAIN**

- A. Protect existing Work from damage. Use barricades, tarpaulins, temporary walls, plywood, planking, masking, or other suitable means and methods as approved by the Architect.
- B. If Work to remain in place is damaged, restore to original condition at no additional cost to the Owner.
- C. Concealed Conditions: If conditions cause changes in the Work from requirements of the Contract Documents, the Contract Sum will be adjusted in accordance with the General Conditions.

### **3.2 PROCEDURES**

- A. Refinishing At Removed Work: Cut below surface of substrate materials and patch over area of removal with finish materials so removal is not apparent.
- B. Remove and replace existing ceilings, and cut, patch, or replace existing walls, partitions and floors as may be necessary for access to valves, piping, conduit and tubing by mechanical and electrical trades as directed and approved by the Architect, and performed by the appropriate subcontractor for the Work involved, or by other properly qualified subcontractors.
- C. Patch and extend existing Work using skilled mechanics who are capable of matching existing quality and workmanship. Quality of patched or extended Work shall be not less than that specified for new Work.
- D. Cutting:
  - 1. Concrete and Masonry: Saw cut where feasible.
  - 2. Plaster: Cut back to sound plaster on straight lines, and back-bevel edges of remaining plaster. Trim and prepare existing lath for tying of new lath.
  - 3. Woodwork: Cut back to a joint or panel line. Undamaged removed materials may be reused.
  - 4. Resilient Tiles: Remove in whole units to natural breaking points or straight joint lines with no damaged or defective existing tiles remaining where joining new construction.
  - 5. Salvaged Materials: Carefully remove to avoid damage, thoroughly clean and reinstall as indicated, or as directed.
  - 6. Doors: Remove in such a manner as to facilitate filling in of openings or installation of new Work, as required by Drawings. **Refer to Finish Hardware Section for specific**

**requirements for salvage of existing finish hardware.** Provide construction cores as required to maintain security and access control.

7. Structural Elements: Remove only as shown on the Structural Drawings. If not specifically shown, but removal is required, perform such removal or alteration only upon written approval of the Architect. Do not damage or alter any structural element of the existing building.

E. Patching:

1. Match existing Work where possible; if unavailable, use salvage material for patching and provide totally new material in areas where salvage has been removed; consult with the Architect concerning locations for salvaging materials.
2. Repairs or continuations of existing Work shall be relatively imperceptible in the finished Work when viewed under finished lighting conditions from a distance of six (6) feet.
3. Patching, Repairing and Finishing of Existing Work: Perform in compliance with the applicable requirements of the Specification Section covering the Work to be performed and the requirement of this Section.

- F. Erect scaffolding as necessary to gain access to the various parts of the Work. Provide structurally sound, rigidly braced and properly constructed scaffolding, shoring, and bracing as necessary to positively protect the affected elements and building, and to support the activities or workmen and loads. Design and construction of scaffolds and supports shall be in accordance with applicable safety regulations. Material used shall be adequate to support anticipated loads with a properly calculated margin of safety.

- G. Noise Producing Equipment: Minimize use of noise producing equipment. Limit excessive noise to periods of vacancy or provide sound control. Arrange schedules in advance with the Architect and Owner.

### 3.3 EXISTING FURNITURE AND EQUIPMENT

- A. Owner Salvaged Items: Personal items in areas subject to remodeling will be removed by Owner before construction in those areas commences. Contractor shall notify Owner if any personal items remain; Owner shall remove such items.
- B. Furniture Items - Renovation: Contractor shall be responsible for any furniture relocation, storage, and move-back necessary to complete scope of work. Contractor to coordinate activities with Owner. Contractor is solely responsible for protecting furniture and equipment and is therefore solely responsible for any damage to said items and ensuing costs in restoring damaged items to same condition or replacing lost or damaged items beyond repair, unless specified as an allowance (Section 01 21 00).

### 3.4 PAINTING

- A. Preparation: Prepare patched areas as required for new Work. Wash existing painted surfaces with neutral soap or detergent, thoroughly rinse, and sand when dry.
- B. Painting and Finishing: Conform to the applicable provisions of the Painting Section. Prepare bare areas and patches in existing painted surfaces with specified primer and intermediate coats, sanded smooth and flush with adjoining surfaces.

### 3.5 DISPOSAL OF DEBRIS

- A. Remove daily material, debris and rubbish resulting from Work of this Section from the building and site as it accumulates. Keep all areas of Work in "broom clean" condition as the Work progresses.

### 3.6 JOB SUPERINTENDENT

- A. If renovation project includes Work at more than one site, Contractor shall have supervision at all sites as follows:

**Cy Creek HS** shall have at least one full-time Superintendent.

### **3.7 FINAL CLEANING**

- A. At completion of renovation and remodeling Work in each area, provide final cleaning of all surfaces and return all areas affected by construction to a condition suitable for use by the Owner. Final cleaning shall include dusting of all surfaces; thorough cleaning of all surfaces including the removal of smudges, marks, stains, fingerprints, soil, dirt, paint spots, lint, discolorations, and other foreign materials; vacuuming of carpets; cleaning of all new carpeting by manufacturer-approved contractor; wet-mop cleaning of tile, and waxing of VCT, terrazzo surfaces per CFISD-approved methods. Refer to section 01 71 50 for Preventive Housekeeping and Final Carpet Cleaning.
- B. To prevent airborne dust from settling on items during the sanding and finishing process of flooring and being relaunched during activities, Contractor shall thoroughly clean all surfaces including but not limited to:
1. Suspended light fixtures,
  2. Exposed mechanical units and systems
  3. Exposed Ductwork
  4. Exposed structural beams, joists or other structural members.

Contractor shall ensure smooth operation of bleacher wheels to prevent dust from floor finishing process preventing the wheels from operating correctly. All surfaces of bleachers shall be thoroughly cleaned including but not limited to seats, supports, structure, and rolling and operating mechanisms.

**END OF SECTION**

## **SECTION 01 36 13.1**

### **CUTTING AND PATCHING**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Execute cutting (including excavating and backfilling), fitting or patching of the work, required to:
  - 1. Make several parts fit properly.
  - 2. Uncover work to provide for installation of ill-timed work.
  - 3. Remove and replace defective work.
  - 4. Remove and replace work not conforming to requirements of the contract documents.
  - 5. Remove samples of installed work as specified for testing.
  - 6. Install specified work in existing construction.
- B. In addition to contract requirements, upon written instruction of the Architect:
  - 1. Uncover work to provide for observation of covered work.
  - 2. Remove samples of installed materials for testing.
  - 3. Remove work to provide for alteration of existing work.
- C. Do not endanger any work by cutting or altering the work or any part of it.
- D. Do not cut or alter the work of another Contractor without written consent of the Architect.
- E. Prior to cutting that affects structural safety of the project or the work of another Contractor, secure written approval of the Architect.

##### **1.2 PAYMENT FOR COSTS**

- A. Costs caused by ill-timed or defective work or work not conforming to the contract documents, including the cost of additional services of the Architect, Third-Party Consultants, and Owner, will be borne by the Contractor.
- B. Work done on written instructions of the Owner or Architect, other than defective or nonconforming work, will be paid by the Owner.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Materials required for replacement of the work removed must conform to the specifications for the type of work to be done.

#### **PART 3 - EXECUTION**

##### **3.1 PREPARATION:**

- A. Provide shoring, bracing and support as required to maintain the structural integrity of the project.
- B. Provide protection for other portions of the project.
- C. Provide protection from the elements.

### **3.2 PERFORMANCE**

- A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.
- C. Execute excavation and backfilling by methods which will prevent damage to other work and will prevent settlement.
- D. Restore work which has been cut or removed; install new products to provide complete work in accordance with requirements of the contract documents.
- E. Refinish entire surfaces as necessary to provide an even finish. On continuous surfaces, refinish to the nearest intersections. For an assembly, refinish the entire item.

**END OF SECTION**

## **SECTION 01 45 00**

### **QUALITY CONTROL**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Quality Assurance: Requirements for material and product quality and control of installation
- B. Tolerances
- C. References and Standards
- D. Mock-ups
- E. Testing Laboratory Services
- F. Inspection Services
- G. Manufacturers' field services

##### **1.2 RELATED SECTIONS**

- A. Section 01 41 00 - Regulatory Requirements
- B. Section 01 45 23 - Testing and Inspecting Services
- C. Section 01 33 00 - Submittal Procedures
- D. Section 02 32 00 - Geotechnical Report
- E. The work of this Section shall be included as a part of all Sections of work, whether referenced therein or not.

##### **1.3 DESCRIPTION OF REQUIREMENTS**

- A. Unless specifically noted otherwise, perform all work shown, mentioned, or reasonably inferred and comply with all work restrictions.
- B. Many of the requirements specified elsewhere are included herein for reference and convenience. Where a conflict occurs between the Contract Documents, either within themselves or each other, the more stringent requirement or the most expensive combination of materials and workmanship shall prevail.
- C. Contractor shall:
  - 1. Perform work in accordance with the General Conditions, as specified herein, and with the quality control requirements of each Specification Section.
  - 2. Perform work in the highest quality workmanship, unless specified otherwise.
  - 3. Join materials with a uniform and accurate fit so they meet with neat straight lines, free of smears, overlaps or irregularities, as applicable to the work.
  - 4. Install all exposed materials appropriately level, plumb, and at accurate angles as shown and flush with adjoining materials.

5. Attach materials with sufficient strength, and with number and spacing of fasteners and attachments that will not fail until materials joined are broken or permanently deformed.
6. Use concealed fasteners, unless shown or directed otherwise.

#### **1.4 QUALITY ASSURANCE AND CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

#### **1.5 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

#### **1.6 REFERENCES AND STANDARDS**

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of Owner-Contractor Agreement except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with contract documents, request clarification from Architect/Engineer before proceeding.
- E. Neither contractual relationships, duties, responsibilities of parties in contract nor those of Architect/Engineer shall be altered from contract documents by mention or inference otherwise in reference documents.
- F. Refer to Section 01 41 00, Codes, Regulations and Standards, for additional information concerning applicable reference and standards requirements.



## 1.7 MOCK-UP REQUIREMENTS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be the comparison standard for remaining work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect.
- E. Mock-up may be approved in phases as portions are completed.
- F. Project Mock-up Requirements: Provide an actual sample mockup wall with multiple panels with the following properties:
  - 1. Size: Minimum 8 feet wide by 8 feet tall. Size may vary according to specific project requirements. Brace and support as required to withstand structural windloads.
  - 2. Materials: actual exterior finishes including, but not limited to face brick, cast stone, and plaster, actual building materials and assemblies indicating brick patterns on masonry and stud back-up as occurs with dampproofing and flashing as detailed, actual portion of aluminum storefront indicating jam, sill and head attachment and flashing details, and where appropriate, provide mock-up of special finish details, insets and reliefs, reveals, expansion and control joints, brick ledges, brick head and sills, pipe penetrations and waterproofing materials. Provide roof edge flashing and gutter section (as applicable) in pre-finished color as selected by Architect to cap the mock-up panel. Include a sealant joint at least 16 inches long. Brick and Mortar color shall be selected by Architect prior to mock-up assembly.
  - 3. Drawing: Refer to mock-up diagram on Drawings for minimum project requirements. Mock-up drawing is for reference only. Actual mock-up drawing will be submitted by the Architect after submittals have been approved.

## 1.8 TESTING SERVICES

- A. Owner will appoint, employ, and pay for specified services of an independent firm to perform testing.
- B. The independent firm will perform tests and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.
- C. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Architect/Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
  - 1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
  - 2. Make arrangements with independent firm and pay for additional samples and tests required.
- F. Testing does not relieve Contractor to perform work to contract requirements.

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- G. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Architect/Engineer. Payment for re-testing will be charged to the Contractor by deducting testing charges from the Contract Sum/Price.
- H. Refer to Section 01 45 29, Inspection and Testing Laboratory Services, for additional information concerning testing, and submittal procedures and requirements for Testing Reports.

## **1.9 INSPECTION SERVICES**

- A. Owner will appoint, employ, and pay for specified services of an independent firm to perform inspection.
- B. The independent firm will perform inspections and other services specified in individual specification sections and as required by the Architect/Engineer, Owner, or authority having jurisdiction.
- C. Inspecting may occur on or off the project site. Perform off-site inspecting as required by the Architect/Engineer or the Owner.
- D. Reports will be submitted by the independent firm to the Owner, Architect/Engineer, and Contractor, indicating inspection observations and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.
  - 1. Notify Architect/Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
- G. Inspecting does not relieve Contractor to perform work to contract requirements.
- H. Refer to Section 01 45 29, Inspection and Testing Laboratory Services, for additional information concerning inspections, and submittal procedures and requirements for Inspection Reports.

## **1.10 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as required, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer within ten (10) days after receipt of Notice to Proceed, in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- D. Refer to Section 01 33 00, Submittal Procedures, for additional information concerning submittal procedures and requirements for Manufacturers Field Reports.

## **PART 2 - PRODUCTS**

Not Used.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify utility services are available, of correct characteristics, and in correct locations.

#### **3.2 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

**END OF SECTION**



## **SECTION 01 45 29**

### **INSPECTION AND TESTING LABORATORY SERVICES**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION** (refer to Document AB for substitutions).

- A. All third-party inspection and testing laboratory services will be provided and paid for by the Owner or by allowance in this contract. An inspection and testing lab will be selected by the Owner and the Contractor will be notified as soon as possible.
- B. The Owner will pay for the initial inspection and testing laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for re-inspection and re-testing of materials that do not comply with the requirements of the Contract Documents, and for re-inspection and re-testing due to “no-shows” and cancellations by Contractor or Subcontractors.
- C. The Contractor shall coordinate and cooperate with the inspection and testing laboratory in all matters pertaining to the work. The Owner retains the option to add to or delete any or all inspection and testing specified herein.
- D. The third-party inspection and testing laboratory services are for the Owner’s benefit. These services shall in no way relieve Contractor of Contractor’s responsibility to provide quality control of all materials incorporated into the Work.
- E. Contractor may be subject to reimbursing owner if the Contractor’s means and methods are shown to cause an overrun in the Owner’s contract with testing lab.
- F. Prior to or during the pre-construction meeting, Contractor shall coordinate with the District’s selected testing lab in order to ensure proposal costs are not exceeded and schedule is congruent to testing proposed. Failure to coordinate may result in backcharges if overages are realized.
- G. Contractor shall submit a construction schedule at time of bid for the testing lab’s use.
- H. Contractor shall allow for in their proposal the coordination and supervision of tests to be performed by an independent laboratory as selected by the Owner.

##### **1.2 RELATED REQUIREMENTS**

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals or public authorities.
- B. Respective Sections of Specifications. Certification of products.
- C. Each Specification Section Listed: Inspection and laboratory test required and standards for inspection and testing.
- D. Testing laboratory inspection, sampling and testing are required for, but not limited to the following:
  - 1. Division 31 - Earthwork
  - 2. Section 03 30 00 - Cast-In-Place Concrete
  - 3. Section 05 31 23– Steel Roof Decking
  - 4. Section 04 20 00 - Unit Masonry
  - 5. Section 05 12 00 - Structural Steel

6. Section 07 52 19 - Modified Bituminous Membrane Roofing System
7. Division 23 - Mechanical (Inspection and testing of welds and bolts on mechanical piping)  
As requested by the Owner, Architect, or Engineer.

### **1.3 AUTHORITIES AND DUTIES OF THE LABORATORY**

- A. The inspection and testing laboratory is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Specifications, or to approve or accept any portion of the Work. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the inspection and testing laboratory shall promptly notify the Owner, General Contractor, Architect, Engineers, supplier and/or subcontractor providing or preparing the materials or work being tested of such deficiencies.
- B. The inspection and testing laboratory shall promptly distribute copies of the laboratory test and inspection reports. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor. The Structural Engineer, Civil Engineer, MEP Engineer, concrete supplier, and any outside consultants shall receive copies of the testing results regarding their particular phase of the Project. Consult with Owner to determine Owner's preference of distribution (hard copy, electronic, etc.).
- C. The testing laboratory shall provide testing services under a separate agreement with the Owner or Architect, who shall be responsible for the costs of initial testing – pass or fail.
  1. The Contractor shall be responsible for costs of all re-tests required to achieve passing results.
  2. The Contractor shall be responsible for charges of the testing lab for expenses incurred for cancelled and/or mis-scheduled testing requests.
  3. The testing lab shall invoice Contractor direct for all re-tests of failed initial tests; and send copies of the invoices to the Architect and Owner for record.
  4. The testing lab and Contractor shall be responsible to negotiate and execute a separate agreement if required by the testing lab for charges described above.
- D. The testing lab is required to furnish a report of the status of testing performed as it relates to anticipated expenses described in the Agreement with the testing lab. Reports shall be furnished at most bi-monthly to the Owner and Architect.
  1. Report information shall include verification that Owner paid testing progress corresponds with anticipated expenses.
  2. The testing lab shall be required to notify the Architect and Owner immediately in writing if/when the testing lab anticipates exceeding the line item and or lump sum fee agreed by Owner.
  3. Such notification must occur prior to expensing 75% of the testing lab fee.

### **1.4 TESTING LABORATORY GUIDELINES AND PROCEDURES**

- A. Technicians scheduled to perform specific inspection and 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 Project site.
- B. Concrete design mixes will receive a cursory review with any discrepancies reported to the Architect/Engineer. No compensation will be considered for these reviews.
- C. Nuclear density testing will be based on a daily rental rate for the actual testing equipment, compensation on a per test basis will not be considered.

- D. Report distribution shall include the Owner, Architect, Contractor, Civil Engineer, Structural Engineer, and others requesting or requiring review of the specific testing results.
- E. Cylinders will be pick-up by the technician performing test the next day in order to have them cure under laboratory conditions.
- F. Structural steel inspections shall include a plant visit reviewing shop fabrication, welding, and an overall review of the shop fabrication quality control standards.
- G. The Contractor shall bear the responsibility of scheduling all the inspection and testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the inspection and testing services. Cancellations and or failed test will be reimbursable to the Owner by the Contractor. Contractor will provide and maintain a sign-in sheet for testing lab services.
- H. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for any hours over eight hours spent at the job site on a single day, field testing services performed on a Saturday or Sunday, and any field services performed on a recognized holiday.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Inspection and 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. Where requirements of this Section are in conflict with requirements noted on the Contract Drawings or other Sections of the Specifications, the more stringent requirement shall apply, unless directed otherwise by Architect.
- C. Should any unusual conditions be encountered during any operations, the laboratory shall be contacted immediately so that additional inspection and testing, as applicable, can be provided.
- D. The Owner reserves the right to add to or delete any or all inspection and testing specified herein.

### **3.2 SITE GRADING**

- A. Testing Services:
  - 1. Perform field tests for moisture density properties.
    - a. In each compacted fill layer, provide one (1) field test for every 5,000 square feet of area, but not less than three (3) tests.
    - b. At paved area, provide one (1) field test for every 5,000 square feet, but not less than three (3) tests.

### **3.3 COMPACTING FILL AND BACKFILL**

- A. Testing Services:
  - 1. Perform field test for moisture density properties:
    - a. Within the building line provide one (1) field test in each compacted layer for every 5,000 square feet of area, but not less than three (3) tests.

### **3.4 PAVING**

**A. Testing Services:**

1. Perform field tests for moisture density properties:
  - a. Provide field testing of the sub-grade as described in Paragraph 3.2, A, 2 above.
  - b. Paving sub-base, provide one (1) field test for every 5,000 square feet of area of crushed limestone or caliche sub-base, if any.
  - c. Lime treated sub-grade, provide one (1) field test for every 5,000 square feet of area of lime treated sub-grade, if any, for content of lime and sub-grade compaction.
  - d. Cement soil stabilization, if any, provide one (1) field test for every 5,000 square feet of area of cement stabilized sub-grade for content of cement and sub-grade compaction.

### **3.5 PIPED SITE UTILITIES**

**A. Inspection and Observation Services:**

1. Inspection of trenches for proper alignment and grade.
2. Inspection of pipe bedding and supports.
3. Inspection of pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
4. Inspection of installation of pipe and joints.
5. Observation of testing of piped utilities performed by Contractor.

### **3.6 EARTHWORK**

**A. Inspection and Observation Services:**

1. Refer to and include, as applicable, work of Paragraphs 3.2, 3.3, 3.4, and 3.5 above.
2. When perimeter and underfloor drainage systems are specified or required, inspect installation of such systems for conformance with specified materials and detail requirements.
3. When temporary drainage and dewatering systems are used to keep excavations dry, inspect the systems for adequacy. Ground water should be maintained at least two (2) feet below bottom of excavation.
4. Review the equipment and methods used in placement and compaction of fill materials and inspect materials used and compaction of fills in general earthwork and in backfilling around structures, and in backfilling in utility trenches.
5. Notify the Contractor in writing and the Architect/Owner immediately if footings and slabs-on-grade are placed on unfinished soil or frozen ground and when footings and slabs-on-grade are not protected from frost damage.
6. Notify the Architect/Owner when soil with allowable bearing capacity noted is encountered at elevation above the bottom of footing shown.
7. Notify the Architect/Owner and Contractor if soil with required bearing capacity noted is not encountered at bottom of footing elevation shown. Bottom of footing shall be adjusted as recommended and approved by the Structural Engineer and Architect.
8. Review rock excavation techniques, if required, and monitor blasting induced ground motions, as appropriate.
9. Review calculations and shop drawings for sheeting, shoring, and underpinning prepared by the Contractor, if required.

**B. Testing Services:**

1. References (As applicable for tests):
  - a. ASTM International (ASTM)



- 1) D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
      - 2) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
      - 3) D4318, 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 (1) in place density test for each 2,500 square feet (280 square yards) of existing subgrade material.
  7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one (1) 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 (1) test for each 2,500 square feet (280 square yards) of each lift of compacted fill.
- C. Reports: Submit reports to Architect/Owner 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 (3) 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/Owner by telephone within one (1) 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.

### 3.7 DRILLED AND UNDERREAMED (BELLED) PIERS

- A. Inspection and Observation Services:
1. Provide full time services for the review of all drilled pier foundation inspections. Including a daily report noting grid lines and locations of each pier drilled. After the foundation shaft has been drilled, the lab shall test an undisturbed sample and verify that it meets or exceeds the design specification.
  2. The drilling and verification of suitable soil for bearing capacity. Notify the Architect when soil with allowable bearing capacity noted is encountered at elevation above the bottom of

pier shown. Notify the Architect and Contractor if soil with required bearing capacity noted is not encountered at bottom of pier elevation shown. Bottom of pier shall be adjusted as recommended and approved by the Structural Engineer and Architect.

- a. Drilled shaft has been drilled plumb and within specified vertical and horizontal tolerances specified by the Structural Engineer.
- b. Drilled shaft and underreamed bells are excavated to specified depths and/or if conditions differ from those presented, to notify the Structural Engineer.
- c. Drilled shaft and underreamed bell bottoms are kept dry at all times, cleaned of excess cuttings, or all obstructions prior to placing reinforcing steel and concrete. If groundwater seepage occurs, it shall be removed prior to concrete placement or controlled with temporary steel casing to maintain the shaft integrity up to the concrete placement.
- d. Concrete reinforcing steel shall be checked for type, size, adequate placement and lap lengths, and doweled bars.

### **3.8 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES**

**A. Inspection and Observation Services:**

1. Inspect all concrete reinforcing steel prior to placing of concrete for compliance with Contract Documents and approved shop drawings. All instances of noncompliance with Contract Documents and approved shop drawings shall be immediately brought to the attention of the Contractor for correction and then, if uncorrected, reported to the Architect/Owner.

**B. Reports:**

1. Observe and Report on the Following:
  - a. Number and size of bars.
  - b. Bending and lengths of bars.
  - c. Splicing.
  - d. Clearance to forms including chair heights.
  - e. Clearance between bars or spacing.
  - f. Rust, form oil, and other contamination.
  - g. Grade of steel.
  - h. Securing, tying, and chairing of bars.
  - i. Excessive congestion of reinforcing steel.
  - j. Installation of anchor bolts and placement of concrete around such bolts.
  - k. Fabrication of embedded metal assemblies, including visual inspection of all welds.
1. 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. Testing Services:**

1. Will be required of all suspect materials or workmanship at the discretion of the Architect, Engineer, or Owner.

### **3.9 REINFORCING STEEL MECHANICAL SPLICES**

**A. Inspection and Observation Services:**

1. Visually inspect and report on the completed condition of each mechanical splice of reinforcing steel.

2. Each mechanical splice shall be visually inspected to ensure compliance with the I.C.B.O. reports and the manufacturer's published criteria for acceptable completed splices.
  3. Special emphasis shall be placed on inspection of the end preparation of each bar to be spliced, as required by the I.C.B.O. Report.
- B. Reports: Submit reports to Architect with the following information:
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. Reasons for rejection shall be shown on each report.

### 3.10 CAST-IN-PLACE CONCRETE

- A. Inspection and Observation Services:
1. Review concrete design mixes proposed for use on the Project.
  2. Provide full time services for all structural building concrete in drilled piers, grade beams, slab on grade, columns, concrete paving, and other miscellaneous structural concrete. Refer to and include work for reinforcement steel specified in Paragraphs 3.8 and 3.9 above.
  3. On the first day's batching of each type and each strength of concrete, inspect and observe materials for concrete, batch weights, moisture content, and gradation of fine and coarse aggregate.
  4. Provide additional inspection if the Contractor elects to use concrete from more than one (1) source of supply simultaneously. All costs for such additional inspection shall be borne by the Contractor.
- B. Testing Services:
1. References (As applicable for field and laboratory tests):
    - a. American Concrete Institute (ACI)
      - 1) 214, Recommended Practice for Evaluation of Strength Test Results of Concrete
      - 2) 318, Building Code Requirements for Reinforced Concrete
    - b. ASTM International (ASTM)
      - 1) C31, Practice for Making and Curing Concrete Test Specimens in the Field
      - 2) C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
      - 3) C138, Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
      - 4) C143, Slump of Hydraulic Cement Concrete
      - 5) C173, Air Content of Freshly Mixed Concrete by the Volumetric Method
  2. Compression Test Cylinders:
    - a. Make, transport, cure and test six (6) inch or (4) inch diameter by 12-inch-long test specimens taken from concrete being cast. Test cylinders will be made, handled, cured, and stored in accordance with ASTM C31, at the rate of four (4) cylinders minimum for each 50 cubic yards slab on grade or elevated slab four (4) cylinders minimum for each 100 cubic yards paving or fraction thereof of each class of concrete placed in any one (1) day.
    - b. Handle newly made cylinders carefully to avoid cracking the green concrete. Store these cylinders in a box at temperatures between 60 degrees F and 80 degrees F during first 24 hours. Contractor shall construct a suitable box and provide heat or cooling, if necessary, to maintain cylinders at proper temperature.

- c. Place cylinders in laboratory storage, with molds removed, under moist curing conditions and temperature of 73 degrees plus or minus three (3) degrees F 24 hours after casting maintain these moist curing conditions until specimens are tested.
  - d. Of the test cylinders taken per 50 cubic yards or fraction thereof, test one (1) at seven (7) days and two (2) at 28 days after casting date. Store one (1) cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements. Test cylinders in accordance with ASTM C39. When Type III cement is used, test at three (3) days instead of seven (7) days.
  - e. Each 28-day compression test report shall clearly indicate average strength results, concrete slump and air content, concrete and ambient air temperatures, and how much water was added on site by contractors as of the report date and for the class of concrete being reported.
  - f. Maintain a moving average for compressive strength based on the three (3) latest 28-day test results to check compliance with specification requirements. The figures for the standard deviation and moving average for strength will be kept continuously up to date and submitted on a weekly basis to the Architect and Engineer. Maintain a continuously up to date log in both graphical and tabulated form for each class of concrete.
    - 1) the average of the latest three (3) test results;
    - 2) the lowest average of three (3) consecutive test results recorded to date;
    - 3) the average of all sets of three (3) consecutive test results;
    - 4) the percentage of tests falling below specified strength;
    - 5) the lowest single test result.
  - g. Maintain a moving average for range of test results for quality control purposes as described in ACI 214, Chapter 4, Paragraphs 4.4 and 4.5. Graphical reports of moving average for range shall be submitted to the Architect and Engineer on a weekly basis.
  - h. Slump Tests: Conduct in accordance with ASTM C143; one (1) test shall be performed for each sampling for strength tests. Slump shall be considered acceptable if the field test is within the range of design slump plus or minus one (1) inch. For concrete placed by pumping, one (1) test shall be performed at the pump and one (1) at the point of deposit. Slump loss through pumping will be acceptable to the Architect and Engineer. Slump measured at the pump shall be evaluated for acceptance relative to the design slump in accordance with the criteria previously specified.
  - i. Air Content Tests: Conduct in accordance with ASTM C173; test air entrained concrete only, one (1) test shall be performed for each sampling for strength tests. Air content shall be considered acceptable if the field test is in the range of the design air content plus two (2) percent.
  - j. Unit Weight Tests: Conduct in accordance with ASTM C138; test each sample of lightweight concrete taken for strength tests. Unit weight shall be considered acceptable if the field test shows a fresh unit weight equal to the design unit weight plus or minus 2 pcf.
  - k. Chloride Tests: Perform one (1) total chloride ion test for each class of concrete placed each day. If the total chloride ion content is determined to be excessive by the Architect or Engineer, water soluble chloride ion tests shall be performed at the Contractor's expense.
3. Noncompliance: In the event the initial tests above indicate that concrete may not meet the specified requirements, the Architect or Engineer may, at his discretion, order additional tests be performed at the Contractor's expense. Load tests shall comply with requirements of ACI 318.

### 3.11 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, 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.
      - 1) 28 Day Compressive Strength
      - 2) Water Retention
    - b. 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 (1) test per 2,000 square feet of masonry.
  4. Refer to and include work for reinforcing steel specified in Paragraphs 3.5 and 3.6 above.
  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) Slump Test
      - 2) 28 Day Compressive Strength
      - 3) 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.
      - 4) Prism Test: Perform preconstruction 28-day compressive strength test on concrete masonry walls in accordance with ASTM E447, Method B.

### 3.12 STRUCTURAL STEEL

- A. Inspection Services:
1. General:
    - a. Review submittals from fabricator.
    - b. Review all shop and field welder's qualifications.
  2. Structural Steel, Steel Joists and Mechanical Piping:
    - a. Shop inspect each member for defects such as cracks, excessive camber, deformation, and specified surface preparation prior to shop priming or galvanizing.
    - b. Inspect shop priming for coverage and measure of mil thickness.
    - c. Perform visual inspection of all welds; measure 15 percent of welds.
    - d. Inspect size and placement of anchor bolts in concrete and masonry.
    - e. Verify that erector surveys plumbness of each column.

- f. Verify that erector inspects alignment of beams, shelf angles, lintels, joists, joist girders, and other similar supporting members.
      - g. Perform visual inspection of bolts to determine that the method(s) used are in conformance with the Contract Documents.
    - 3. Metal Decks:
      - a. Field inspect material for type, gauge, finish and other requirements of the Contract Documents.
      - b. Field inspect installation methods including welding, alignment, joints, laps, and flatness, and all other requirements of the Contract Documents.
    - 4. Steel Stud Shear Connectors:
      - a. Field inspect installation methods and welds.
      - b. Verify number of studs, stud placement and length for conformance with the Contract Documents.
  - B. Testing Services:
    - 1. References (As applicable for tests required):
      - a. American Institute of Steel Construction (AISC)
        - 1) Specifications for Structural Joints Using ASTM A325 or A490 Bolts
      - b. ASTM International (ASTM)
        - 1) A6, General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
        - 2) A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
        - 3) A490, Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
      - b. American Welding Society (AWS)
        - 1) D1.1, Structural Welding Code, Steel
    - 2. Structural Steel:
      - a. Perform all tests required by Structural Welding Code and authorities having jurisdiction.
      - b. Ultrasonically test all edges of material greater than 1-1/2 inch thick that is to be welded for evidence of laminations, inclusions, or other discontinuities. The extent to which such defects will be permitted, and the extent of repair permitted shall be in accordance with ASTM A6.
      - c. The root layer of all multiple pass welds and the backside of groove welds made from both sides, after back gouging or chipping, shall be tested by magnetic particle or dye penetration if magnetic particle is not feasible.
      - d. Fillet welds for beam and girder shear connections (15 percent at random) shall be tested by magnetic particle for final pass only.
      - e. Fillet welds for plate girder flange/web connections shall be tested by magnetic particle for final pass only.
      - f. Ultrasonically test 100 percent of full penetration welds.
      - g. Ultrasonically test 100 percent of partial penetration column splice welds.
      - h. Test 100 percent of continuity plate fillet welds by magnetic particle for final pass.
      - i. Perform all equipment calibrations and production tests of high strength bolt connections as required by AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
      - j. Randomly sample bolts, nuts, and washers from the Project Site at a rate sufficiently to test and verify compliance with ASTM Standards.
      - k. When bolts are tightened by "turn-of-the-nut" method, check by calibrated torque wrench 25 percent of bolts in each shear connection, but not less than two (2) bolts per connection.
      - l. In addition, provide at least one (1) test per 50 linear inches of weld by each welder, except that 100 percent of full penetration welds shall be tested using approved

- radiographic, magnetic particle, or ultrasonic method. Tolerance for welds shall be in accordance with the requirements of AWS D1.1 and the Contract Drawings.
- m. Perform tension tests on steel in accordance with ASTM A6, if required.
  - n. Perform load tests on structural members in place, if required.
3. Steel Stud Testing:
- a. Test not less than ten (10) percent of studs on any beam, plus all studs indicating imperfections. Studs will be considered imperfect if, after welding, visual inspection reveals:
    - 1) Studs lacking full 360-degree weld.
    - 2) Studs which have been repaired by welding.
  - b. Studs shall be tested by striking with a hammer and bending to approximately 15 degrees off vertical. Bend studs lacking full 360 degrees weld in a direction opposite to the side lacking the weld. Replace studs that crack after this test either in the weld or the shank. Studs meeting this test will be considered acceptable and left in place.

### 3.13 SPRAYED-ON FIREPROOFING

- A. Inspection Services:
  - 1. Inspection of sprayed-on fireproofing to ascertain compliance with Contract Documents.
- B. Testing Services:
  - 1. References (As applicable for tests required):
    - a. ASTM International (ASTM)
      - 1) E605, Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
      - 2) E736, Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
  - 2. Perform tests on sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
  - 3. Perform tests on sprayed-on fireproofing for cohesion and adhesion in accordance with ASTM E736.

### 3.14 LIGHTWEIGHT INSULATING CONCRETE FILL

- A. Inspection and Observation Services:
  - 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 Testing Lab to ascertain minimum withdrawal resistance of 40 pounds per square foot per fastener, based on ANSI/SPRI Protocol. Architect and Roofing Inspector to witness fastener pull tests.
- B. Testing Services:
  - 1. References (As applicable for tests required):
    - a. ASTM International (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 (1) per 5,000 square feet
  - 2) Not less than one (1) for each day's work
- 4. Test EPS insulation board for density in accordance with ASTM C578.

### 3.15 ROOFING SYSTEM

- A. Inspection and Observation Services:
  - 1. Attend pre-construction meeting prior to Contractor starting work.
  - 2. Attend pre-installation meetings for decking, lightweight concrete, roofing, and sheet metal installations.
  - 3. Review field mockups of sheet metal and other components as applicable.
  - 4. Inspect on-site condition of stored roofing materials
  - 5. Provide full-time roofing inspector during the following stages of construction:
    - Final stages of metal deck attachment
    - Lightweight concrete roof deck application
    - Modified bitumen roofing and metal roofing application
  - 6. Provide spot inspections for sheet metal work and thru-wall flashing. Thru-wall flashing shall be left open by the Contractor until inspected, and sheet metal shall not be covered until inspected.
  - 7. Witness water tests and pull tests completed by others.
  - 8. Observe roof test cuts, and patching of cuts, performed by Contractor to ascertain that they are properly made.
  - 9. 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.
  - 10. Provide a written daily report in standardized format to Owner within 72 hours of inspection. The report shall describe all roofing-related activities as well as recommendations made to Contractor by the Inspector. The report shall also include a running list of items from previous reports that have not yet been addressed by Contractor. The reports shall also include an itemization of items that should be backcharged to the Contractor. Submit report to Contractor, Architect, and Owner.
  - 11. Provide and maintain a sign-in sheet in the construction trailer. **Inspector shall sign in and out for every inspection, or Owner will not pay for that inspection.**
  - 12. Attend the punch list walk and provide a written punch list of all roofing components to Architect and Owner.
  - 13. Conduct a final inspection of all roofing components and provide Owner with a letter confirming that all punch list items are complete.
  - 14. Review Siplast Warranty and provide a letter to the Owner confirming that it is correct and complete.

### 3.16 GLAZED SYSTEMS, TRANSLUCENT WALL PANEL SYSTEMS AND SKYLIGHTS

- A. Testing Services:
  - 1. Perform air and water infiltration testing on initial installation of each exterior glazed system, translucent wall panel system and skylight to ascertain compliance with specifications.

## PART 4 – GENERAL – PROJECT CONSULTANT OBSERVATIONS

### 4.1 DESCRIPTION



- A. The Contractor shall include in his Proposal the coordination and scheduling of Observations to be performed by the Owner and Architect's project consultants, as they may apply to this work.
- B. All project consultant observation services shall be performed by designees of the relative consultant; upon which the Contractor may rely as to the capability and thoroughness of the observation being performed. Upon request by the Contractor, the names of inspectors performing specific observations shall be furnished by the Architect.
- C. The Owner shall pay for the observation services of the project consultants in accordance with the Owner / Architect Agreement and the requirements of the Contract Documents. Excessive observations and re-observations resulting from the Contractor's actions as described in paragraph 4.4 below, shall be paid for by the Contractor directly to the affected Consultant.
- D. The Contractor shall cooperate with the Owner's project consultants in all matters pertaining to required observations of the work as described in the Contract Documents. The Owner retains the option to add to or delete any or all observations specified herein; and thereby accept the relative work without observation.

#### **4.2 RELATED REQUIREMENTS**

- A. Conditions of the Contract, AIA Document A201 as amended, and Supplementary Conditions to the General Conditions for the Construction Contract, Specification section CA.
- B. Respective Sections of Specifications describing the required consultant observations.

#### **4.3 AUTHORITIES AND DUTIES OF THE PROJECT CONSULTANT INSPECTORS**

- A. The project consultant inspectors are not authorized to revoke, alter, relax, increase, or release the Contractor from any requirement of the Contract Documents without written notice furnished to the Contractor by the Architect. When it appears that the material, assembly or work performed by the Contractor fails to fulfill Contract requirements, the project consultant inspector shall promptly notify the General Contractor, Architect and Owner.
- B. The project consultant inspector(s) shall distribute copies of the observation reports within two (2) working days. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor.

#### **4.4 PROJECT CONSULTANT OBSERVATION GUIDELINES AND PROCEDURES**

- A. Project Consultants shall make all observations required in the Contract Documents and requested by the Architect, Contractor and/or Owner.
- B. For each material, assembly or phase observation required in the Contract Documents, and upon request by the Contractor, the project consultant(s) shall perform the following observations as required in the Owner – Architect Agreement:
  - 1. Initial observation to determine compliance with the Contract Documents.
  - 2. Observation to determine deficiencies where the initial observation results do not show 100% compliance with the Contract Documents. At the consultant's discretion, this observation may be performed concurrent with the initial observation.

The above series of observations shall be at the expense of the Owner in accordance with the Owner/Architect Agreement. If re-observation is required to determine 100% compliance is required, it shall be at Contractor's expense.

- C. In the event the observation series described above does not result in 100% approval of the material, assembly or phase being inspected, all subsequent re-observations required to achieve 100% approval

shall be at the sole expense of the Contractor to be paid to the project consultant (via Owner backcharge to the Contractor) based on the consultant's standard hourly rates for time expended, including travel to and from the site.

- D. Recognizing the size and complexity of work included in a project may be sufficiently large enough to require the project to be divided into scope areas, each such area shall be considered separate and stand-alone with respect to paragraph 4.4.B above. Requests by the Contractor for project consultant observations of partial scope areas shall be considered observations of the entire scope area with respect to paragraph 4.4.B above; and subsequent observations of the remaining portions of the same scope area shall be paid for by the Contractor (via Owner backcharge to the Contractor). Owner shall invoice the Contractor on a monthly basis, and payment shall be due upon the Contractor's receipt of the invoice.
- E. The Contractor shall bear the responsibility of requesting and scheduling all project consultant observations required by the Contract Documents. The Contractor shall give the project consultant a minimum of forty-eight (48) hours' notice prior to the requested observation. No extension of Contract Time shall be granted for untimely observations due to the Contractor's failure of proper observation request notification.
- F. Observations voluntarily made by project consultants at their discretion, not specifically requested by the Contractor, shall not count as one of the observations described in paragraph B above, nor shall the Contractor be liable for any related expenses.

#### **4.5 PROJECT CONSULTANT OBSERVATIONS**

- A. Earthwork
- B. Site Utilities prior to cover-up
- C. Concrete Reinforcing
- D. Cast-in-place concrete
- E. Structural steel
- F. All Building Envelope assemblies
- G. Mechanical rough-in prior to cover-up
- H. Plumbing rough-in prior to cover-up
- I. Electrical rough-in prior to cover-up
- J. Above ceiling prior to cover-up
- K. Start-up demonstrations of building systems and components
- L. Punch lists (treated separately for each architect and consultant). Refer to Specification Section CA, section 9.8
- M. Observation / review of O&M Manuals and other close-out documents
- N. Observation / review of Record Drawings

#### **4.6 PROJECT CONSULTANT HOURLY RATES**

- A. Refer to the A201 General Conditions of the Contract for Construction, as Amended Article 8 for applicable hourly rates.

## **PART 5 – GENERAL – GOVERNMENTAL INSPECTIONS**

### **5.1 DESCRIPTION**

- A. The Contractor shall include in his Proposal the application, coordination, scheduling and cost of all on-site inspections to be performed by governmental authorities having jurisdiction which are required for approval of the Work and occupancy of the building; including, but not limited to all City departments, all County departments, Flood Control Districts, Municipal Utility Districts, utility provider, Health Departments and Fire Marshal Offices.
- B. The Contractor shall make all corrective measures in accordance with instructions received from the governing authority inspector having jurisdiction, as required to receive 100% approval for the work being inspected.
- C. The Contractor shall bear all costs for initial inspections, re-inspections and any other expenses related to on-site inspections made by governing authority.
- D. No allowance shall be made for additional Contract Time, nor an increase in the Contract Sum for any unanticipated expenses or delays resulting from failed governmental inspection or resulting re-inspections required to obtain approval(s).

### **5.2 EXCLUSION**

- A. The Contractor shall not be responsible for making application, coordination, inspections and receiving approval of the Work by the Texas Department of Licensing and Regulation relative to ADA and Texas Accessibility Standards.

**END OF SECTION**



## SECTION 01 50 00

### TEMPORARY FACILITIES

CONDITIONS OF THE CONTRACT and DIVISION 1, as indexed, apply to this Section.

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Refer to Instructions to Proposers for substitutions.
- B. Temporary facilities shall only be for the duration of construction, unless noted otherwise, and all temporary facilities shall be completely removed at the completion of the project. Any areas disturbed by the placement of temporary facilities shall be repaired/replaced to a finished condition consistent with the surrounding finished area.

##### 1.2 UTILITIES

- A. The Contractor shall supply temporary job power, drainage outfall, sanitary sewer, and water hook-ups for site. The Contractor shall provide all wiring, lamps, distribution of power and similar equipment as required for construction, inspection, and testing of each project.
- B. The Contractor is responsible for overloading or excess use, or any damage resulting from overloading or excess use, or any damage resulting from his use of utilities.
- C. The General Contractor shall provide temporary heat to prevent freezing and maintain proper temperatures to avoid damage to materials in the building and allow work to continue in such weather conditions. The General Contractor shall provide and maintain such dependable source of supply, such as heat, as may be necessary until the building is accepted.
- D. The Contractor will be required to provide temporary water and electrical connections for field sprinkler systems after Substantial Completion of the fields. These connections must be maintained through the duration of the Contract, or until permanent connections are made.
- E. Any utility usage at existing buildings in excess of 110% of historical usage for the previous 12-month period shall be paid by the Contractor.

##### 1.3 FIELD OFFICE

- A. The Contractor will be required to furnish a job trailer installed at a suitable location (on site), for use by the Contractor, Architect, and Owner.
- B. Provide and maintain a weather-tight building with operable and lockable door and windows, to serve as a job office available to the Contractor, subcontractors, Owner, and the Architect. Provide lights, electricity, air conditioning and heat, as required. Remove office from premises when one can be set up inside the building. Provide job site telephone, internet, and other miscellaneous items as outlined below.
  - 1. Provide a separate lockable room (120 sq. ft.) in Contractor's job trailer to serve as an office for the Architect and Owner's representative or provide in a separate building in close proximity to Contractor's office.
  - 2. Contractor's office shall be of a size, and shall be furnished, so that it may be used for small progress meetings (seating for approximately 8 persons at table).
  - 3. Provide adequate artificial lighting, heating and cooling to provide comfortable conditions for occupants.
  - 4. Provide direct line telephone service for both voice communication and internet connection.
  - 5. Furnishings Required:
    - a. Contractor's Office: Racks and files for Contract Documents and for Record Documents; conference table and chairs; and desks and chairs as required by Contractor.

- b. Architect's Office: One lay-out drafting table 36" x 72" x 36" high; one standard desk with three drawers; chair and drafting stool. Provide one drawing rack for 30" x 42" drawings.
- 6. Provide high speed data access with internet access and wireless access point/router.

#### **1.4 SANITARY FACILITIES**

- A. Furnish temporary sanitary facilities and maintain in compliance with regulations of State Department of Health and other authorities having jurisdiction (minimum of one water closet and hand sink).

#### **1.5 STORAGE FACILITIES**

- A. Provide and maintain adequate weathertight lockable storage facilities, raised above the ground, with sides and top enclosed.
- B. Replace materials improperly stored and damaged by weathered conditions.
- C. Remove storage facilities when materials are stored within the structure in a weathertight condition.
- D. Allow for temporary freeze protection as needed.
- E. Address any storage needs for owner equipment, furniture, etc.

#### **1.6 SIGNS**

- A. Within three weeks after receipt of Notice to Proceed, provide one project identification sign and install in a location designated by the Owner at each campus.
- B. Fabricate the sign with sturdy wood framing and 3/4-inch-thick exterior grade plywood, with aluminum overlay and applied digitally printed vinyl sign, a minimum area of 64 cumulative square feet (8' x 8'). No other signs, except as allowed herein, shall be allowed to be displayed on the site. Contractor shall submit a scaled shop drawing of the sign, including all lettering, to the Owner for approval prior to installation.
- C. Project sign shall incorporate design layout as provided by Architect, and shall include:
  - 1. The official title of the Project as listed on Contract Documents.
  - 2. The name of the Owner as listed on Contract Documents.
  - 3. The names and titles of School Board Members and School Administrators.
  - 4. The names and titles of Architect.
  - 5. Identification number of the Contractor.
- D. Erect signs on 4" (102 mm) x 4" (102 mm) supports set firmly into the ground and well braced. The bottom of the sign is to be a minimum of 4' above grade, unless otherwise instructed by the Architect.
- E. Other signs required at the site:
  - 1. Warning, directional, and identification signs as required to indicate construction office location, and to facilitate campus operations that are impacted by construction.
- F. Contractor shall provide necessary signage to accommodate all Owner needs necessitated by the Work including temporary walking/driving routes, deliveries, etc.
- G. Allow no other signs to be displayed at the project site, unless authorized by the Owner.
- H. Secure and pay for all sign permits as required by local authorities.
- I. The sign shall remain the property of the Owner, and upon final completion, the Contractor shall remove the sign and deliver it to a location designated by the Owner or dispose of sign if directed by Owner.

## **1.7 BARRIERS**

- A. Provide temporary barricades on all portions of the site as required to secure the construction area and affected areas of building and site.
- B. Provide approved barriers around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, water puddling and continuous running water.
- C. Provide temporary partitions as needed to separate work areas from building occupants.

## **1.8 SECURITY**

- A. Determine if and when watchmen are necessary for protection to the work and provide such services when necessary. Neither the provision of watchmen nor the failure to provide watchmen shall relieve the Contractor of responsibility in event of injury to persons or damage to property.

## **1.9 CLEANING**

- A. Trash Removal: Clear the building and site daily of trash. When rapid accumulation occurs, make more frequent removals. Remove highly combustible trash such as paper and cardboard daily. Dumpsters will not be allowed to overflow and should be emptied on a regular basis. Subcontractors shall provide their own dumpsters for disposal of their debris.
- B. Daily cleanup (renovation and new construction projects): Daily cleanup is required both within construction area, and also for any areas on site that are used by Owner (sidewalks, drives, roads, corridors, etc.).
- C. Disposition of Debris: Remove debris from the site and make legal disposition. Locations for disposal shall be of the Contractor's choice within the above restriction. Neither debris nor material may be buried or burned at the site. Take necessary precautions to prevent accidental burning of materials by avoiding large accumulations of combustible materials.
- D. Refer to Section 01 71 50 for Preventive Housekeeping.

## **2.0 TEMPORARY FIRST AID FACILITIES**

- A. Provide first aid equipment and supplies, with qualified personnel continuously available to render first aid at the site.
- B. Provide a sign, posted at the telephone, listing the telephone numbers for emergency medical services: physicians, ambulance services and hospitals.
- C. Provide and maintain one Automated External Defibrillator (AED) unit throughout duration of the project.

## **2.1 TEMPORARY FIRE PROTECTION**

- A. Provide a fire protection and prevention program for employees and personnel at the site; and provide and maintain fire extinguishing equipment ready for instant use at all areas of the project, and at specific areas of critical fire hazard.
- B. Equipment:
  - 1. Hand extinguishers of the types and sizes recommended by the National Board of Fire Underwriters to control fires from particular hazards.
  - 2. Barrels of water with buckets designated for fire control purposes.
  - 3. Water hoses connected to an adequate water pressure and supply system.
  - 4. Construction period use of permanent fire protection system.

- C. Enforce Fire-safety Discipline:
  - 1. Store volatile materials in an isolated, protected location.
  - 2. Avoid accumulations of flammable debris and waste in or about the Project.
  - 3. Prohibit smoking on CFISD property and in the vicinity of hazardous conditions.
  - 4. Closely supervise welding and torch-cutting operations in the vicinity of combustible materials and volatile conditions, including roofing torching operations.
  - 5. Supervise locations and operations of portable heating units and fuel.
- D. Maintain fire extinguishing equipment in working condition, with current inspection certificate attached to each extinguisher.
- E. Contractor shall coordinate and comply with all requirements of Owner's personnel, as well as those of governing authorities.

## **2.2 CONSTRUCTION AIDS**

- A. Provide construction aids and equipment required to assure safety for personnel and to facilitate the execution of the work; scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other equipment.
- B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
- C. Maintain all equipment in a first-class, safe condition.

## **2.3 ACCESS ROADS AND PARKING AREAS**

- A. Submit to CFISD for review and upon written approval, provide adequate temporary roads and walks to achieve all-weather car access into the site from public thoroughfares, and within and adjacent to the site, as necessary to provide interrupted access to field offices, work and storage areas. All temporary access roads and walks shall be removed upon completion of permanent facilities, or completion of construction.
- B. Provide adequate parking space for personnel and employees at the site, located to avoid interference with traffic adjacent school facilities and functions, work or storage areas, or with materials-handling equipment.
- C. Grade and provide drainage facilities to assure runoff of rainwater and to avoid blockage of flow from adjacent areas.

**END OF SECTION**



SECTION 01 55 26

TRAFFIC CONTROL AND REGULATION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.
- B. Qualifications and requirements for use of flagmen.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Price Contracts.
  - 1. Traffic control and regulation. Payment for traffic control and regulation is on a lump sum basis. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor's Schedule of Values for traffic control and regulation.
  - 2. Flagmen. Payment for flagmen is on a lump sum basis. Partial payments will be based on Contractor's Schedule of Values for flagmen.
  - 3. New Portable Concrete Low Profile Traffic Barrier Provided. Payment is on a unit price basis for each linear foot of low profile traffic barrier provided, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
  - 4. Portable Concrete Low Profile Traffic Barrier picked up from Stockpile. Payment is on a unit price basis for each linear foot of low profile traffic barrier picked up from designated stockpile, moved onto the project, set at location and connected together.
  - 5. Portable Concrete Low Profile Traffic Barrier Installed. Payment is on a unit price basis for each linear foot of low profile traffic barrier delivered to the project location, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
  - 6. Portable Concrete Low Profile Traffic Barrier Moved and Reset. Payment is on a unit price basis for each linear foot of low profile traffic barrier disassembled, moved on the project, reset at the new locations and connected together. Include cost to repair roadway in the unit price.
  - 7. Portable Concrete Low Profile Traffic Barrier Removed. Payment is on a unit price basis for each linear foot of low profile traffic barrier removed from the project, including hardware assemblies, and stockpiling at location listed in Division 1. Include cost to repair roadway in the unit price.
  - 8. Refer to Division 1 for unit price procedures.
- B. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

- A. Texas Manual on Uniform Traffic Control Devices (TMUTCD)
- B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Traffic control plan:
  - 1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
  - 2. If using a different traffic control plan, submit the plan for approval. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer.

- C. Submit copies of approved lane closure permits issued by all governmental authorities.
- D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.
- E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.

#### 1.5 FLAGMEN

- A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.
- B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.
  - 1. Uniformed Peace Officers may be:
    - a. Sheriffs and their deputies;
    - b. Constables and deputy constables;
    - c. Marshals or police officers of an incorporated city, town or village; or
    - d. As otherwise provided by Article 2.12, Code of Criminal Procedure.
  - 2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.
- C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:
  - 1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center.
  - 2. Speaks English. Ability to speak Spanish is desirable but not required.
  - 3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City of Houston's Wage Scale for Engineering Construction.
- D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

### PART 2 PRODUCTS

#### 2.1 SIGNS, SIGNALS, AND DEVICES

- A. Comply with TMUTCD requirements.
- B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

#### 2.2 PORTABLE LOW PROFILE CONCRETE BARRIERS

- A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

### PART 3 EXECUTION

#### 3.1 PUBLIC ROADS

- A. Submit requests forms for lane closure and sidewalk closure to the appropriate governmental authority at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits.
- B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Owner's Representative.
- C. Give Owner's Representative one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.
- D. Notify police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.
- E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.
- F. Do not obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Owner's Representative.
- G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Owner's Representative to maintain temporary driveway access to commercial and residential driveways.
- H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.
- I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.
- J. Provide safe access for pedestrians along major cross streets.
- K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.
- L. Do not close more than two consecutive esplanade openings at a time without prior approval from Owner's Representative.

### 3.2 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Owner's operations.
- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

### 3.3 FLARES AND LIGHTS

- A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

### 3.4 HAUL ROUTES

- A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

### 3.5 TRAFFIC SIGNS AND SIGNALS

- A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the governmental agency having jurisdiction a minimum of 60 days in advance of need for control boxes and switchgear. The Contractor will pay for all necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.
- B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.
- C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.
- D. Unless otherwise approved by Owner's Representative, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.
- E. Replace existing traffic control devices in Project area.
- F. Owner's Representative may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the Owner.

### 3.6 BRIDGING TRENCHES AND EXCAVATIONS

- A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.
- B. Shore trench or excavation to support bridge and traffic.
- C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
  - 1. Bridging is placed over existing bus routes,
  - 2. More than five percent of daily traffic is comprised of commercial or truck traffic,
  - 3. More than two separate plates are used for bridging, and
  - 4. When bridge is to be used for more than five consecutive days.
- D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

### 3.7 REMOVAL

- A. Remove equipment and devices when no longer required.
- B. Repair damage caused by installation.
- C. Remove post settings to a depth of 2 feet.

### 3.8 TRAFFIC CONTROL, REGULATION AND DIRECTION

- A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:
  - 1. Multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
  - 2. Vehicular traffic must change lanes abruptly,
  - 3. Construction equipment must enter or cross vehicular traffic lanes and walks,
  - 4. Construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,
  - 5. Traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and

6. Where construction activities might affect public safety and convenience.

- B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.9 INSTALLATION STANDARDS

- A. Place temporary pavement for single lane closures, in accordance with TMUTCD.
- B. Reinstall temporary and permanent pavement markings as approved by Owner's Representative. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Owner's Representative for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

- A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Owner's Representative. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.
- B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Owner's Representative. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.
- C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.
- D. Obtain approval of Owner's Representative to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION

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SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Division 1.
- B. Installation and maintenance of storm-water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.
- C. Filter Fabric Fences:
  - 1. Type 1: Temporary filter fabric fences for erosion and sediment control in non-channelized flow areas.
  - 2. Type 2: Temporary reinforced filter fabric fences for erosion and sediment control in channelized flow areas.
- D. Straw Bale Fence.

1.2 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. Payment for filter fabric fence is on a linear foot basis measured between limits of beginning and ending of stakes.
  - 2. Payment for reinforced filter fabric fence is on a linear foot basis measured between limits of beginning and ending of stakes.
  - 3. Payment for drop inlet baskets is on a unit price basis for each drop inlet basket.
  - 4. Payment for storm inlet sediment traps is on a unit price basis for each storm inlet sediment trap.
  - 5. Payment for storm-water-pollution-prevention structures is on a lump sum basis for the project. Earthen structures with outlet and piping includes diversion dikes, interceptor dikes, diversion swales, interceptor swales, and excavated earth-outlet sediment trap, embankment earth-outlet sediment trap, down spout extenders, pipe slope drains, paved flumes, stone outlet sediment trap, and level spreaders.
  - 6. Payment for straw bale barrier, if included in Bid Form, is on a linear foot of accepted bale barriers, if not include in cost of storm-water-pollution-prevention structures.
  - 7. Payment for brush berm, if included in Bid Form, is on a linear foot of accepted brush berm, if not include in cost of storm water-pollution-prevention structures.
  - 8. Payment for sandbag barrier, if included in Bid Form, is on a linear foot basis measured between limits of beginning and ending of sandbags, if not include in cost of storm-water-pollution prevention structures.
  - 9. Payment for sediment basin with pipe outlet or stone outlet, if included in Document 00410 - Bid Form, is on a square yard basis, if not include in cost of storm-water-pollution-prevention structures.
  - 10. Payment for inlet protection barriers, if included in Document 00410 - Bid Form, is on a linear foot basis measured along outside face of inlet protection barrier, if not include in cost of storm-water-pollution prevention structures.
  - 11. Refer to Division 1 for unit price procedures.
- B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCE STANDARDS

A. ASTM

1. A 36 - Standard Specification for Carbon Structural Steel.
  2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)].
  3. D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.
  4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
  5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
  7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
  8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.
- B. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

#### 1.4 SYSTEM DESCRIPTIONS

- A. Filter Fabric Fence Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Fences to remain in proper position and configuration at all times.
- B. Straw Bale Fence: Install to allow surface runoff percolation through straw in sheet-flow manner and to retain and accumulate sediment. Maintain Straw Bale Fence to remain in proper position and configuration at all times.
- C. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.
- D. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.
- E. Sediment traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.

#### 1.5 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit manufacturer's literature for product specifications and installation instructions.
- C. Submit manufacturer's catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.
- D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.
- E. Submit shop drawings for Drop Inlet Baskets.

### PART 2 PRODUCTS

#### 2.1 CONCRETE

- A. Concrete: Class B in accordance with Division 1 or as shown on the Drawings.

#### 2.2 AGREGATE MATERIALS

- A. Use poorly graded cobbles with diameter greater than 3 inches and less than 5 inches.



- B. Provide gravel lining in accordance with Division 2 or as shown on the drawings.
- C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.
- D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

### 2.3 PIPE

- A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Division 2 or as shown on the Drawings.
- B. Inlet Pipes: Galvanized steel pipe in accordance with Division 2 or as shown on the Drawings.
- C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

### 2.4 GEOTEXTILE FILTER FABRIC

- A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.
- B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.
- C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.
- D. Mirafi, Inc., Synthetic Industries, or equivalent.

### 2.5 FENCING

- A. Wire Fencing: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24 inch roll or sheet width of longest practical length.
- B. Fence Stakes: Nominal 2 x 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 8 inch bury and full height of filter fabric.

### 2.6 SANDBAGS

- A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
  - 1. Minimum unit weight of four ounces per square yard.
  - 2. Minimum grab strength of 100 psi in any principal direction (ASTM D4632).
  - 3. Mullen burst strength exceeding 300 psi (ASTM D3786).
  - 4. Ultraviolet stability exceeding 70 percent.
  - 5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 50 to 125 pounds.

### 2.7 DROP INLET BASKET

- A. Provide steel frame members in accordance with ASTM A36.
- B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

## 2.8 STRAW BALE

- A. Straw: Standard-baled agricultural hay bound by wire, nylon, or polypropylene rope. Do not use jute or cotton binding.
- B. Straw Bale Stakes (applicable where bales are on soil): No. 3 (3/8 diameter) reinforcing bars, deformed or smooth at Contractor's option, length as required for minimum 18 inch bury and full height bales.

## PART 3 EXECUTION

### 3.1 PREPARATION, INSTALLATION AND MAINTAINANCE

- A. Provide erosion and sediment control structures at locations shown on the Drawings.
- B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manager to allow installation of erosion and sediment control systems, soil testing and surveying.
- C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manager to remove and discard existing system.
- D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. . Redress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Project Manager. Dispose of materials in accordance with Division 1.
- E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Division 1.
- F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Division 2.
- G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.
- H. Protect existing trees and plants in accordance with Division 1.

### 3.2 SEDIMENT TRAPS

- A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.
- B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.
- C. Use fill material for embankment in accordance with Division 2.
- D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.
- E. Stone outlet sediment traps:
  - 1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.
  - 2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.

- F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.
- G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

### 3.3 FILTER FABRIC FENCE CONSTRUCTION METHODS

#### A. Fence Type 1

1. Install stakes 3 feet on center maximum and firmly embed minimum 8 inches in soil. If filter fabric is factory pre-assembled with support netting, then maximum support spacing is 8 feet. Install wood stakes at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench configuration as shown on Drawings may also be used.
3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
4. Staple filter fabric to stakes at maximum 3 inches on center. Extend fabric minimum 18 inches and maximum 36 inches above natural ground.
5. Backfill and compact trench.

#### B. Fence Type 2

1. Layout fence same as for Type 1.
2. Install stakes at 6 feet on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
3. Tie wire fence to stakes with wire at 6 inches on center maximum. Overlap joints minimum one bay of mesh.
4. Install trench same as for Type 1.
5. Fasten filter fabric wire fence with tie wires at 3 inches on center maximum.
6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
7. Backfill and compact trench.

- C. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install stakes at a slight angle toward source of anticipated runoff.

- D. Trench in toe of filter fabric fence with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

- E. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

- F. Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6 inch overlap and seal securely.

#### G. Triangular Filter Fabric Fence Construction Methods

1. Attach filter fabric to wire fencing, 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter fence in place using one of the following methods:
  - a. Toe-in skirt 6 inches with mechanically compacted material;
  - b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
  - c. Trench-in entire structure 4 inches.
3. Anchor triangular fabric filter fence structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.

4. Lap fabric filter material by 6 inches to cover segment joints. Fasten joints with galvanized shoat rings.

#### H. Reinforced Filter Fabric Barrier Construction Methods

1. Attach woven wire fence to fence stakes.
2. Securely fasten filter fabric material to wire fence with tie wires.
3. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.
4. Remove sediment deposits when silt reaches depth one-third height of barrier or 6 inches, whichever is less.

### 3.4 DIKE AND SWALE

- A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.
- B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.
- C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.
- D. Clear in accordance with Division 2.
- E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

### 3.5 DOWN SPOUT EXTENDER

- A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Division 2.

### 3.6 PIPE SLOPE DRAIN

- A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.
- B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.
- C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.
- D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.
- E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

### 3.7 PAVED FLUME

- A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.
- B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.

- C. Construct permanent paved flumes in accordance with Drawings.
- D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.8 LEVEL SPREADER

- A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.
- B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.9 INLET PROTECTION BARRIER

- A. Place sandbags and filter fabric fences at locations shown on the SWP3.

3.10 DROP INLET BASKET CONSTRUCTION METHODS.

- A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.
- B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.
- C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.
- D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 STRAW BALE FENCE CONSTRUCTION METHODS

- A. Place bales in row with ends tightly abutting adjacent bales. Place bales with bindings parallel to ground surface.
- B. Embed bale in soil a minimum of 4 inches.
- C. Securely anchor bales in place with Straw Bale Stakes driven through bales a minimum of 18-inches into ground. Angle first stake in each bale toward previously laid bale to force bales together.
- D. Fill gaps between bales with straw to prevent water from channeling between bales. Wedge carefully in order not to separate bales.
- E. Replace with new straw bale fence every two months or as required by Owner's Representative.

3.12 BRUSH BERM CONSTRUCTION METHODS

- A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.
- B. Use woody brush and branches having diameter less than 2-inches with 6-inches overlap. Avoid incorporation of annual weeds and soil into brush berm.
- C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches minimum and side slopes shall be 2:1 or flatter.
- D. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.13 STREET AND SIDEWALK CLEANING

- A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Division 1.
- B. In lieu of or in addition to stabilized construction exits, shovel or sweep pavements as required to keep areas clean. Do not water hose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

#### 3.14 WASTE COLLECTION AREAS

- A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

#### 3.15 EQUIPMENT MAINTENANCE AND REPAIR

- A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.
- B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

#### 3.16 VEHICLE/ EQUIPMENT WASHING AREAS

- A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Division 1. Install gravel or rock base beneath wash areas.
- B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourses or storm water conveyance systems.
- C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

#### 3.17 WATER RUNOFF AND EROSION CONTROL

- A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.
- B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.
- C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
- D. Dispose of drainage water to prevent flooding, erosion, or other damage to the site or adjoining areas. Follow environmental requirements.
- E. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.
- F. Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
  - 1. Hold area of bare soil exposed at one time to a minimum.
  - 2. Provide temporary controls such as berms, dikes, and drains.
- G. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

- H. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.
- I. Dispose of sediments offsite, not in or adjacent to streams or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.
- J. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8-inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.
- K. Do not maneuver vehicles on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.
- L. Do not damage existing trees intended to remain.

3.18 REMOVAL OF CONTROLS

- A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Owner's Representative.
- B. Dispose of sediments and waste products following Division 1.

END OF SECTION

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SECTION 01 57 23.10

TPDES REQUIREMENTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 (the Construction General Permit).
- B. Implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.
- C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with the Owner's Representative prior to start of construction.

1.2 DEFINITIONS

- A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.
- B. Large Construction Activity: Project that:
  - 1. Disturbs five acres or more, or
  - 2. Disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.
- C. Small Construction Activity: Project that:
  - 1. Disturbs one or more acres but less than five acres, or
  - 2. Disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.
- D. TPDES Operator:
  - 1. The person or persons who have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

- A. Prepare a SWP3 following Part III of the Construction General Permit and the applicable local code. If conflicts exist between the Construction General Permit and the local regulations, the more stringent requirements will apply.
- B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.
- C. Submit the SWP3 and any updates or revisions to the Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.

### 3.2 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

- A. Fill out, sign, and date TCEQ Form 20022 Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000).
- B. Transmit the signed Contractor's copy of TCEQ Form 20022, along with a check for the required fee, made out to Texas Commission on Environmental Quality.
- C. Submission of the Notice of Intent form by the Contractor to TCEQ is required a minimum of two days before Commencement of Construction Activities.

### 3.3 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

- A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR 150000, "Construction Site Notice."
- B. Transmit the signed Construction Site Notice to the Engineer at least seven days prior to Commencement of Construction Activity.

### 3.4 CERTIFICATION REQUIREMENTS

- A. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the EPA NPDES Construction Inspection Form

### 3.5 RETENTION OF RECORDS

- A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to the Owner's Representative.

### 3.6 REQUIRED NOTICES

- A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:
  - 1. Post the TPDES permit number for Large Construction Activity, or a signed TCEQ Construction Site Notice for Small Construction Activity. A signed copy of the Contractor's NOI must also be posted.
  - 2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
    - a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with the Owner's Representative to conform to requirements of the Construction General Permit.
    - b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
  - 3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.
  - 4. Post a notice of waste disposal procedures in a readily visible location on site.

### 3.7 ON-SITE WASTE MATERIAL STORAGE

- A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

- B. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.
- C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.8 NOTICE OF TERMINATION

- A. Submit a NOT to TCEQ and the Engineer within 30 days after:
  - 1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
  - 2. Another operator has assumed control over all areas of the site that have not been stabilized; and
  - 3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.

END OF SECTION

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SECTION 01 57 23.11

STABILIZED CONSTRUCTION EXIT

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Installation of erosion and sediment control for stabilized construction exits used during construction and until final development of the site.

1.2 SUBMITTALS

- A. Manufacturer's catalog sheets and other product data on geotextile fabric.
- B. Sieve analysis of aggregates conforming to requirements of this Specification.

1.3 UNIT PRICES

- A. Unless indicated in the Unit Price Schedule as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items for which this work is a component.
- B. When indicated in the Unit Price Schedule, include stabilized exits under payment for Street Cleaning as Required by NPDES, including stabilized construction roads, parking areas, exits, and truck washing areas will include and be full compensation for all labor, equipment, materials, supervision, and all incidental expenses for construction of these items, complete in place, including, but not limited to, embankment and excavation, maintenance requirements, repair and replacement of damaged sections, removal of sediment deposits, redressing of aggregates and stones, cleaning of streets, and removal of erosion and sediment control systems at the end of construction.

1.4 REFERENCES

- A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 PRODUCTS

2.1 GEOTEXTILE FABRIC

- A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.
- B. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632), and the equivalent opening size between 50 and 140.
- C. Both the geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable life at a temperature range of 0°F to 120°F.
- D. Representative Manufacturers: Mirafi, Inc., or equal.

2.2 COARSE AGGREGATES

- A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. Aggregate shall be composed of clean, hard, durable materials

free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

- B. Coarse aggregates shall conform to the following gradation requirements.

<u>Sieve Size</u> <u>(Square Mesh)</u>	<u>Percent Retained</u> <u>(By Weight)</u>
2-1/2"	0
2"	0 - 20
1-1/2"	15 - 50
3/4"	60 - 80
No. 4	95 - 100

### PART 3 EXECUTION

#### 3.1 PREPARATION AND INSTALLATION

- A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, Contractor shall provide stabilized construction roads and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.
- B. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than as specifically directed by the Owner's Representative to allow soil testing and surveying.
- C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Owner's Representative to remove and discard the existing system.
- D. Regularly inspect and repair or replace components of stabilized construction exits. Unless otherwise directed, maintain the stabilized construction roads and exits until the project is accepted by the Owner. Remove stabilized construction roads and exits promptly when directed by the Owner's Representative. Discard removed materials off site in accordance with the requirements of Division 1.
- E. Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil site is not designated on the Drawings, dispose of sediment off site at location not in or adjacent to a stream or floodplain. Off-site disposal is the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into a stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state, and local rules and regulations.
- F. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.
- G. Conduct all construction operation under this Contract in conformance with the erosion control practices described in Division 1.

#### 3.2 CONSTRUCTION METHODS

- A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.
- B. Provide stabilized construction exits, and truck washing areas when approved by Owner's Representative, of the sizes and locations where shown on Drawings or as specified in this Section.
- C. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, Contractor shall construct a truck washing

area. Truck washing shall be done on stabilized areas which drain into a drainage system protected by erosion and sediment control measures.

- D. Details for stabilized construction exit are shown on the Drawings. Construction of all other stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential.
- E. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.
- F. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.
- G. The length of the stabilized area shall be as shown on the Drawings, but not less than 50 feet. The thickness shall not be less than 8 inches. The width shall not be less than the full width of all points of ingress or egress.
- H. Stabilization for other areas shall have the same coarse aggregate, thickness, and width requirements as the stabilized construction exit, except where shown otherwise on the Drawings.
- I. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Owner's Representative.
- J. Alternative methods of construction may be utilized when shown on Drawings, or when approved by the City Engineer. These methods include the following:
  - 1. Cement-Stabilized Soil - Compacted cement-stabilized soil or other fill material in an application thickness of at least 8 inches.
  - 2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.
  - 3. Steel Mats - Perforated mats placed across perpendicular support members.

END OF SECTION 01 57 23.11

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SECTION 01 57 23.12

CONTROL OF GROUND WATER

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.
- B. Protecting work against surface runoff and rising floodwaters.
- C. Trapping suspended sediment in the discharge from the surface and ground water control systems.

1.2 MEASUREMENT AND PAYMENT

A. UNIT PRICES

- 1. Measurement for control of ground water, if included in Bid Form, will be on either a lump sum basis or a linear foot basis for continuous installations of well points, eductor wells, or deep wells.
- 2. If not included in Bid Form, include the cost to control ground water in unit price for work requiring such controls.
- 3. No separate payment will be made for control of surface water. Include cost to control surface water in unit price for work requiring controls.
- 4. Follow Division 1 for unit price procedures.

- B. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600kN-m/m<sup>3</sup>))
- B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA)
- C. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.4 DEFINITIONS

- A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.
  - 1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.
  - 2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.
- B. Excavation drainage: includes keeping excavations free of surface and seepage water.

- C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.
- D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.
- B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Division 2 to produce following results:
  - 1. Effectively reduce hydrostatic pressure affecting:
    - a. Excavations
    - b. Tunnel excavation, face stability or seepage into tunnels
  - 2. Develop substantially dry and stable subgrade for subsequent construction operations
  - 3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work
  - 4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata
  - 5. Maintain stability of sides and bottom of excavations
- C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.
- D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.
- E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.
- F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
- G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.
- H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.
- I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

#### 1.6 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit Ground Water and Surface Water Control Plan for review by Owner's Representative prior to start of excavation work. Include the following:
  - 1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control
  - 2. Names of equipment Suppliers and installation Subcontractors

3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures
4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics
5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
7. Operating requirements, including piezometric control elevations for dewatering and depressurization
8. Excavation drainage methods including typical drainage layers, sump pump application and other means
9. Surface water control and drainage installations
10. Proposed methods and locations for disposing of removed water

C. Submit following records upon completion of initial installation:

1. Installation and development reports for well points, eductors, and deep wells
2. Installation reports and baseline readings for piezometers and monitoring wells
3. Baseline analytical test data of water from monitoring wells
4. Initial flow rates

D. Submit the following records weekly during control of ground and surface water operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Comply with requirements of agencies having jurisdiction.
- B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.
- C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.
- D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

## PART 2 PRODUCTS

### 2.1 EQUIPMENT AND MATERIALS

- A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Owner's Representative through submittals required in Paragraph 1.06, Submittals.
- B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed.
- C. Maintain equipment in good repair and operating condition.
- D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

- E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
  - 1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

### PART 3 EXECUTION

#### 3.1 GROUND WATER CONTROL

- A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan submittal.
- B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.
- C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.
- D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.
- E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.
- F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.
- G. Removal of ground water control installations.
  - 1. Remove pumping system components and piping when ground water control is no longer required.
  - 2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
  - 3. Remove monitoring wells when directed by Owner's Representative.
  - 4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.
- H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.
- I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.
- J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.
- K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.

- L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.
- M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

### 3.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

- A. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.
- B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.
- C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.
- D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.
- E. Replace installations that produce noticeable amounts of sediments after development.
- F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.06B.

### 3.3 SEDIMENT TRAPS

- A. Install sediment tank as shown on approved plan.
- B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

### 3.4 SEDIMENT SUMP PIT

- A. Install sediment sump pits as shown on approved plan.
- B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.
- C. Extend standpipe 12 inches to 18 inches above lip of pit.
- D. Convey discharge of water pumped from standpipe to sediment trapping device.
- E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

### 3.5 EXCAVATION DRAINAGE

- A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

### 3.6 MAINTENANCE AND OBSERVATION

- A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.

- B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.
- C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations.
- D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Owner's Representative.

3.7 MONITORING AND RECORDING

- A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also, monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.
- B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Owner's Representative determines more frequent monitoring and recording are required. Comply with Owner's Representative's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

3.8 SURFACE WATER CONTROL

- A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.
- B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION

## **SECTION 01 71 23**

### **FIELD ENGINEERING**

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Measures to ensure adequate quality control and quality assurance for all Work in accordance with Conditions of the Contract, as specified herein, and with the quality control and quality assurance requirements of each Specification Section, and authorities having jurisdiction.

##### **1.2 RELATED SECTIONS**

- A. All Sections of Work requiring layout, survey, reference points and their verification and protection, and quality control and assurance monitoring requirements.

##### **1.3 DEFINITIONS**

- A. Survey and Field Engineering: Wherever the terms “Survey”, “Field Engineering” or any derivative thereof, or similar term appears within this Section, they mean one and the same, and shall mean the survey or field engineering work performed by the Field Engineer as defined below and is separate from that of the survey work provided by the Owner.
- B. Field Engineer: Wherever the term “Field Engineer” or any derivative thereof, or similar term appears in the Contract Documents, it shall refer to the General Contractor’s employee(s) that are expert in, routinely engaged in, and have at least five (5) years experience in, the practice of construction project field engineering, building and project layout, construction measurements and monitoring, etc.
- C. “Construction Surveyor”: Wherever the term “Construction Surveyor”, or any derivative thereof, or similar term appears in the Contract Documents, the entity (person or firm) licensed as a Registered Professional Land Surveyor or Professional Engineer of the discipline required for specific service on the Project in the State in which the Project occurs, with five (5) years minimum experience, and meeting all applicable regulations of the State in which the Project occurs and Department of Labor, and other authorities having jurisdiction to perform the Work. To avoid any misunderstanding or lack of interpretation, the entity responsible for performing the Work of this Section shall be employed by the General Contractor, and the responsibility, including methods and means, is totally that of the General Contractor.
- D. Quality Control and Quality Assurance: Wherever the terms “Quality Control”, “Quality Assurance” or any derivative thereof, or similar term appears in the Contract Documents, they mean one and the same, and shall mean an aggregate of activities of the General Contractor, such as design analysis and statistical sampling with inspection for defects, designed to ensure adequate quality in materials and workmanship whether factory manufactured or jobsite produced.

##### **1.4 QUALITY CONTROL AND QUALITY ASSURANCE**

- A. Employ a Construction Surveyor complying with the definition above and acceptable to the Owner and Architect, to perform all Construction Surveying. Provide full responsibility for the Construction Surveyor and accuracy of the performance of all items of Work shown on Drawings, specified herein, or in other Specification Sections.

## **SUBMITTALS FOR REVIEW**

- A. Submit name, address, telephone number, fax number, and registration number of the proposed Construction Surveyor prior to starting Work of this Section.
- B. Submit evidence of Construction Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate, if different from Construction Manager's.
- C. Upon request by Architect, submit documentation verifying accuracy of all Survey Work, including a certificate sealed and signed by the Construction Surveyor, that the elevations and locations of the Work are in conformance with Contract Documents and such information has been incorporated into the Project Record Documents.
- D. Submit Project Record Documents under provisions of Section 01 77 00, Closeout Procedures.

## **PART 2 - PRODUCTS**

Not Used

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of discrepancies discovered.

### **3.2 SURVEY REFERENCE POINTS**

- A. Locate and protect survey control and reference points.
- B. Control datum for survey is that established by the Owner provided survey and as indicated on Drawings.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original Owner's survey control. Make no changes without prior written permission of Architect.

### **3.3 FIELD ENGINEERING AND CONSTRUCTION SURVEYOR REQUIREMENTS**

- A. Establish a minimum of two (2) permanent benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data, on Project Record Documents.
- B. Field Engineer shall establish elevations, lines and levels. Locate, lay out, and monitor by instrumentation and similar appropriate means Work, including, but not be limited to:
  - 1. elevations, and layout of property lines and easements;
  - 2. site drainage, including storm water control and pollution prevention measures, slopes, swales, and invert elevations;
  - 3. limits of clearing and grubbing, including identification of trees and planting to be removed and methods for protection of those to remain;



4. excavations, fill and topsoil placement, and all (rough and finish) grades;
  5. trenching and trench safety;
  6. utility locations;
  7. concrete and asphaltic concrete paving, curbs, ramps, and other site improvements, as applicable;
  8. grid or axis for structures, batter board locations;
  9. elevation, grade controls, and layout of building foundation and grade beams, column locations, base plates, embedded items, depressions, formwork, and openings in concrete, including all interior finish grades;
  10. elevations of structural steel, including, steel joists/trusses, steel decks, and associated miscellaneous metals;
  11. elevations and layout of masonry, including concrete masonry units (CMU), face brick, cast stone, and other elements built-in masonry.
  12. elevations and slopes of roofing, including those for lightweight insulating concrete deck system, if applicable.
  13. elevations and layout of work as required to ensure proper operation, clearances, and tolerances, including conveying systems, plumbing and mechanical work; and
  14. monitoring of movement and protection of existing or adjacent structures, as applicable.
- C. Throughout course of Work, verify existing conditions and layouts by same means as originally used to ensure conformance with design requirements and details. Notify Architect immediately, if discrepancies are found.
- D. Provide one (1) copy each of reduced Field Engineer's notes to the Architect, Owner, Construction Surveyor, and affected Consultant within four (4) working days of completion of each portion of the Field Engineering Work.
- E. Field Engineer's notes shall be clear and complete. The Field Engineer shall be available at no expense to the Owner, Architect, or Consultants for note interpretation, if required.
- F. Field Engineer shall perform surveys to determine quantities of unit cost work, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- G. Provide Construction Surveying services. Utilize recognized engineering survey practices.
- H. Construction Surveyor shall verify and record/document their findings, on a drawn survey at a scale matching that of the original Contract Documents, for the following:
1. All property lines and corners
  2. All building corners
  3. All paving corners
  4. Finish floor of all/each buildings
  5. Invert elevations, flow lines for all site drainage structures and improvements
- I. Payment for earthwork quantities shall be for materials in place, compacted, and determined by neat line method.
- J. Provide the Owner a reproducible hard copy and digital/electronic file copy of all the Construction Surveyor's work.

### **3.4 PROJECT RECORD DOCUMENTS**

- A. Maintain a complete and accurate log of control and Field Engineer work as it progresses.
- B. Upon completion of Work, including, but not limited to earthwork, formwork, foundation, structural steel erection, and major site improvements, prepare Project Record Documents illustrating dimensions, locations, angles, and elevations of construction and site work.
- C. Submit Project Record Documents as specified in Paragraph 1.5.

**END OF SECTION**

## SECTION 01 71 50

### PREVENTIVE HOUSEKEEPING AND FINAL CARPET CLEANING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

#### PART 1 – GENERAL

##### 1.1 SCOPE OF WORK

- A. Cleaning of new and existing Tandus Powerbond carpet within the Project work area at the end of each work window upon substantial completion of work scheduled each day. Work window shall be determined by and coordinated with Owner.
- B. Clean entire area of building where construction or scope of work occurs, and all areas affected by construction activities including but not limited to dirt, debris and construction dust.
- C. Preventive Daily Housekeeping. The following are intended as a guide to facilitate the daily maintenance and cleanliness of the construction site, including but not limited to:
  - 1. Renovations involving the commons cafeteria where the stage curtain may be exposed/soiled by construction materials, dirt, dust etc. the curtain shall be removed prior to construction and stored according to curtain Manufacturer's recommended procedures and methods. Contractor reinstall after final cleaning. Contractor is responsible for curtain cleaning should it become soiled from construction activities per Curtain Manufacturer's methods.
  - 2. Contractor to segregate phased and/or areas of construction from all other areas of the building with a sealed, airtight construction barrier.
  - 3. Contractor shall provide additional AHU air filtration to protect existing Owner HVAC systems and other areas of building from becoming soiled from construction activities and dust. Should construction dirt and dust accumulate in affected construction areas, Contractor shall provide final cleaning of those spaces.
  - 4. Contractor is to prevent daily accumulation of construction dust or any other material that can cause any safety hazard.
  - 5. Contractor to eliminate, as practical as possible, tracking of dirt and debris prior to entering building each time.
  - 6. In an effort to protect existing flooring surfaces, Contractor is responsible for providing adhesive plastic sheeting and Masonite and/or plywood to prevent accumulation of all contaminants, including but not limited to: dirt, damaging foot traffic, lift equipment, machinery oil, etc. Continuously inspect and provide replacement/maintenance as needed of sheeting and Masonite/plywood as appropriate to construction intensity.
  - 7. Daily cleaning and maintenance of existing carpet to utilize procedure itemized in subsection 3.1 prior to cold water extraction.

#### PART 2 – PRODUCTS

##### 2.1 CERTIFIED MAINTENANCE PARTNERS

- A. Corporate Care  
Phone: 713-692-6300  
Attn: Sean Barnett
- B. GCA Services Group  
Phone: 972-276-5858  
Attn: Dub Spencer

- C. Texan Floor Service  
Phone: 713-956-9966  
Attn: Jeff Hill

## 2.2 MATERIALS

- A. Cleaning Solutions: Cleaning solutions shall be used according to manufacturer's instructions. Review the material safety data sheets (MSDS) and/or safety data sheet (SDS), and product labels on solutions, being aware of any precautions and usage guidelines.
1. Below are the minimum requirements for cleaning solutions to be used on C&A carpet. Contact your supplier to assure that these guidelines are met:
    - a. Shall be safe and non-toxic.
    - b. Shall contain no optical brighteners.
    - c. Shall have a pH between 5 and 9 diluted for normal cleaning.
    - d. Do not leave a sticky or oily residue when dried.
    - e. Will not damage carpet's fiber or color.
    - f. Will not promote rapid soiling.
  2. Conduct the following test to evaluate the type of residue a solution leaves behind:
    - a. Prepare the solution and pour in a pan.
    - b. Place in direct sunlight and allow to evaporate. If it leaves a sticky or oily residue, do not use. The carpet manufacturer can provide approved cleaning agents and deodorizers for the specific carpet. These cleaners have been tested for appropriate pH levels, absence of optical brighteners and zero resoil potential.

## 2.3 EQUIPMENT

- A. Equipment: Use the effective, well-functioning equipment:
1. Vacuum Cleaner: Use a commercial vacuum cleaner that exceeds the established industry standards for soil removal. For improved indoor air quality, the vacuum shall have high efficiency filtration and shall emit minimal particles into the air. (The carpet manufacturer can provide a list of suggested vacuum cleaners.)
  2. Pile Lifter: Use a pile lifter to assist in the cleaning process to aggressively lift the pile fiber and loosen attached soil prior to vacuuming. Because of this aggressiveness, caution must be used when cleaning C&A's Syntex® products. (The carpet manufacturer can provide a list of suggested pile lifters.)
  3. Extractors: Provide hot water extraction for final deep cleaning and maintenance.
    - a. Selection should be based upon the needs of the facility. In general, the following minimum performance should be considered:
      - 1) Extractor should be C&A approved and capable of extracting a maximum volume of water injected into carpet pile fiber.
      - 2) Components should be made of a material that is non-corrosive and will not rust or deteriorate in the presence of water and/or cleaning solutions.
      - 3) Extractor should be able to generate a minimum of 50 pounds per square inch (psi) of pressure and should not exceed 400 psi.
      - 4) The carpet manufacturer can provide a list of suggested extractors.
  4. Portable Air Mover:
    - a. Carpet can dry within 2 to 3 hours in most environments. Drying time should never exceed 12 hours.
    - b. When extreme environmental conditions exist (relative humidity exceeds 65%), an air mover or drying fan should be used to accelerate drying time.
    - c. The carpet manufacturer can provide a list of suggested portable air movers

## PART 3 – EXECUTION

### 3.1 PROCEDURE

#### A. Cleaning Procedures:

##### 1. Vacuuming

- a. Make sure the vacuum cleaner is in proper working order before each use. (Clean all components regularly.)
- b. Use slow, overlapping passes. Slowing the vacuum down allows the suction to loosen and remove the embedded dry soil that can abrade and damage fibers.
- c. Pay careful attention to the “pull” stroke. More soil is removed in this action than in the forward stroke.
- d. Empty vacuum bags when they become half full to improve soil removal.
- e. Replace nylon brushes at the first sign of wear.
- f. Use only original equipment manufacturer parts for consistent performance.

##### 2. Spill Removal

- a. Spills may require cleaning solutions to remove.
- b. The spill/liquid should be blotted into paper or cloth towels.
- c. Place several layers of towels over the spill and apply pressure until all of the excess liquid has been removed.
- d. Use a portable spot removal extractor with cold water solution.

##### 3. Spot Removal

- a. Determine if the spot is a water-soluble or oil-based stain by applying clean water and blot with absorbent towel. Water-soluble spots will transfer to the towel; oil-based spots will not. Clean spot using one of the following methods:
  - 1) For water-based spots: Continue rinsing with water as long as there is transfer to the towel. A cleaning agent may not be necessary if water continues to remove the spot. If a cleaning agent is needed, apply a Manufacturer approved (Collins and Aikman for TanduS carpets) spot lifter to the area and allow to soak for 5 minutes. Then, flush thoroughly with water until all detergent residue has been removed. Repeat this process until the spot is removed.
  - 2) For oil-based spots: After blotting to remove excess liquid, apply a non-water based dry-cleaning solvent\* to a towel and apply to the spot. (Applying a dry-cleaning solvent directly to the Carpet surface may allow the spot to spread.) Work from the outer edges of the spot to limit spreading. Continue to reapply solution in this manner until the spot is completely removed. Then flush thoroughly with water until all residue has been removed. In case of permanent stains, repairs may be necessary.\*Dry-cleaning solvents denote isopropyl alcohol, denatured alcohol and other, non-water-based cleaning solutions.

##### 4. Extraction

- a. In addition to vacuuming and spot removal, extraction will help maintain Carpet’s appearance.
- b. The procedure for effective soil removal is as follows:
  - 1) Pile lift all heavy soiling areas.
  - 2) Thoroughly vacuum the entire area to remove dry soil.
  - 3) Never use detergent in the extractor rinse tank.
  - 4) Pre-spray the area with an approved pre-spray solution.
  - 5) Use agitation for improved cleaning results.
  - 6) Allow the solution to remain undisturbed for 5 to 10 minutes. This will make the soil easier to remove.
  - 7) Extract the area thoroughly to rinse and remove all the detergent and soil.
  - 8) Repeat until recovery water is relatively clean.
  - 9) Place air movers on the area to expedite the drying time.
  - 10) Limit foot traffic on the area until dry.
- c. Extraction equipment guidelines:

- 1) Make sure extractor is in proper working order.
- 2) Disinfect freshwater tank and recovery tank on a weekly basis.
- 3) Replace nylon brushes at the first sign of wear.
- 4) Use only original equipment manufacturer parts for consistent performance.
5. Tape Residue Removal
  - 1) Following removal of carpet and flooring protective measures, including but not limited to plastic sheeting, adhesive plastic sheeting, Masonite, tape, etc., Contractor is responsible for complete removal of tape residue (per flooring manufacturer recommendations) from flooring surfaces prior to final cleaning.

### 3.2 SCHEDULE

- A. Traffic Patterns: Identify and evaluate the traffic patterns in the facility and get approval from Owner. Using a floor plan of the facility, color code the plan to identify each of the areas.
- B. Cleaning Schedule:
  1. Track-Off Areas: Areas where outside soil is tracked in (entrances, lobbies, restrooms, elevators, and areas next to hard-surface flooring). These areas require specific attention.
    - a. Pre-vacuum prior to spot cleaning
    - b. Spot clean to remove entrenched stains
    - c. Vacuum again using multiple passes
    - d. Pile lift to loosen embedded soil prior to extraction
    - e. Wet extract in each direction using multiple passes to achieve desired appearance level
    - f. Spot clean as necessary
    - g. Vacuum
  2. Heavy Traffic Zones: Areas that experience more than 1,000 foot traffics per day (staging areas, traffic lanes, pivot points and funnel areas)
    - a. Vacuum using multiple passes
    - b. Pile lift to loosen embedded soil prior to extraction
    - c. Wet extract to achieve desired appearance level
    - d. Spot clean as necessary
    - e. Vacuum
  3. Moderate Traffic Zones: Areas that experience 500 to 1,000 foot traffics per day (secondary hallways, administrative areas, offices, and light-use common areas)
    - a. Vacuum using multiple passes
    - b. Pile lift to loosen embedded soil prior to extraction
    - c. Wet extract to achieve desired appearance level
    - d. Spot clean as necessary
    - e. Vacuum
  4. Light Traffic Zones: Areas that experience less than 500-foot traffics per day (conference rooms, areas outside of traffic lanes, and limited use-area)
    - a. Vacuum using multiple passes
    - b. Wet extract as necessary to achieve desired appearance level
    - c. Spot clean as necessary
    - d. Vacuum

5. Areas Prone to Spots and Stains: (break rooms, coffee areas and areas near kitchens)
  - a. Pre-vacuum prior to spot cleaning
  - b. Spot clean to remove undesirable stains
  - c. Pile lift and wet extract as required according to traffic zone identification above
  - d. Spot clean again as necessary
  - e. Vacuum

**END OF SECTION**





## SECTION 01 77 00

### GUARANTEES, CERTIFICATES AND CLOSE-OUT

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION I APPLY TO THIS SECTION.

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Certain procedures have been developed and are required to fulfill all provisions of the Owner-Contractor Agreement with respect to contract Final Completion and Contract Close-Out for the work/project to be 100% complete.
- B. Refer to AIA Document A201™-2017, General Conditions of the Contract for Construction; as amended and Section CB – Supplementary Conditions of the Contract for Construction; as amended for additional information and requirements.

#### PART 2 - SUBSTANTIAL COMPLETION

##### 2.1 GENERAL

- A. Projects that involve phase sequential construction of major definable areas of projects that involve separate work on multiple campuses shall have Certificates of Substantial Completion issued for each phase or campus, as applicable and agreed upon by the Owner and Contractor. All conditions for Substantial Completion, including liquidated damages, shall apply for each date of Substantial Completion for each phase or campus, as applicable.
- B. Individual Substantial Completion Dates for each phase or campus shall be determined and agreed upon by the Owner, Architect and Contractor. Where an Alternative Proposal dictating a required, guaranteed completion date (dates) is included in the Proposal Form and accepted by the Owner, the date(s) stated therein shall establish the Substantial Completion Dates to be incorporated into the Agreement.
- C. The following items are a partial list of requirements, as applicable to the Project, which must be completed prior to establishment of a Substantial Completion date. Refer to substantial completion checklist contained within the AIA Document A201™-2017, General Conditions of the Contract for Construction as amended for a complete list.
  - 1. All fire alarm system components must be completed and demonstrated to the Owner.
  - 2. All inspections by government authorities having jurisdiction over the project must have been finalized, any remedial work required by them must have been completed, and Certificates of Occupancy, local fire marshal and health department approval certificates and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
  - 3. All exterior clean-up and landscaping must be complete, including required stand of grass mowed, edged, weeded, and fertilized.
  - 4. All interior shall have been completed and cleaned except minor items which, if complete after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. Contractor shall provide list of these specific items, which include punch list and completion items. 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 shall be the sole judge of what constitutes a significantly large number of items.
  - 5. All third-party HVAC air and water balancing must be complete.

6. All energy management systems must be complete, fully operational and demonstrated to the Owner, with graphics transferred to the main server.
  7. All emergency/standby generator and low voltage lighting control systems must be complete, fully operational and demonstrated to the Owner.
  8. All security systems must be complete, fully operational and demonstrated to the Owner, and must be monitorable from the District's central Police/Security Center.
  9. All school communications equipment, telephone systems and P.A. systems must be complete and demonstrated to the Owner.
  10. All final lockset cores must be installed and all final Owner directed keying completed.
  11. All room plaques and exterior signage must be complete.
  12. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment and all life safety systems.
  13. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
  14. All operation and maintenance manuals are delivered and approved by Architect and Owner ("D-slant" ring binders in duplicate).
  15. Health Department Inspections and Municipal Utility District (MUD) and Drainage District and County approvals must be provided.
  16. All other reports, testing results, certifications, studies, etc. required by Contract Documents.
- D. Final Cleaning:
1. The work area shall be thoroughly cleaned inside and outside. Cleaning includes removal of smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces. Refer to Section 01 71 50 for final clean requirements of remodel areas and carpet.
  2. Remove all temporary facilities.
- E. In order for the project, a major portion thereof, a project phase or project campus 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 them 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, interior and exterior, shall have been completed and cleaned except minor items (Punch List) which, if completed after occupancy, will not, in the Owner's opinion, cause any interference to the Owner's use of the building or any portion thereof.
  3. All items stipulated in 2.1-C above.
- F. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner, at his sole discretion, may make (partial) payment of retainage applying to such work or designated portion thereof which is 100% complete and accepted by the Owner. Such payment, if made at all, shall be adjusted in the Owner's favor for work that is incomplete or not in accordance with the requirements of the Contract Documents.
- G. The date of Substantial Completion shall represent day one (1) of the thirty (30) day period to complete all work and correct all deficiencies contained in the Punch List and the ninety (90) day period allowed for complete Contract Close-Out as described below.

## 2.2 PUNCH LIST

- A. A comprehensive list prepared by the Contractor prior to Substantial Completion, and attached thereto, to establish all items to be corrected, or limited items of work to be completed, if any. This list is intended to represent a limited number of items needing attention.
- B. Punch lists shall be furnished to the Architect in Microsoft Excel and PDF formats. The punch list shall be in matrix form and shall include the following information for each punch list item:

1. Room number or other suitable location identifier
  2. Description of the work
  3. Sub-contractor/trade sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
  4. Sub-contractor/trade sign-off date
  5. General contractor sign-off that the work has been verified to be 100% complete and in accordance with the Contract Documents
  6. General contractor/trade sign-off date
  7. A/E consultant sign-off
  8. A/E consultant sign-off date
  9. If requested by the Owner, provide two additional similar columns for their sign-off
  10. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes/items" that shall be applied to the entire project; and it shall be the responsibility of the contractor/sub-contractor to thoroughly examine the entire project and make corrective measures at all applicable locations.
- C. Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for re- inspection and revision. The date of Substantial Completion will be delayed until the punch list submitted is a reasonable representation of the work to be done.
- D. 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. It is anticipated that the detailed list of items of work to be completed or corrected at the Date of Substantial Completion.
- E. The Contractor's superintendent shall participate in the preparation of the Contractor's punch list that is submitted to the Architect and Owner for supplementation. Upon receipt, the Architect and Consultants shall perform a spot review to determine the adequacy and completeness of the Contractor's punch list.
- F. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants, and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list.
1. The Superintendent shall record or otherwise take note of all supplementary items.
  2. The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

## **2.3 OPERATIONS AND MAINTENANCE MANUALS**

- A. Operation and Maintenance (O&M) Manuals shall be delivered prior to, and are a condition of, Substantial Completion to allow the Owner the benefit of having the manuals for on-site training and start-up procedures provided by the Contractor.
- B. Operation and Maintenance (O&M) Manuals shall provide concise descriptions, technical information, principles of operation; operating instructions, maintenance instructions and schedules, MSDS sheets, and other information that will enable the proper on-going operation and maintenance of the material and/or assembly.
- C. Separate O&M Manuals shall be provided for the following as applicable to the project scope of work:

1. Architectural materials, equipment and/or assemblies
  2. Food services materials, equipment and/or assemblies
  3. Mechanical materials, equipment and/or assemblies
  4. Plumbing materials, equipment and/or assemblies
  5. Electrical materials, equipment and/or assemblies
  6. Low-voltage systems materials, equipment and/or assemblies
  7. Theater lighting/sound systems materials, equipment and/or assemblies
- D. Provide O&M Manuals/information for all materials, equipment and/or assemblies where required in individual sections of specifications.
- E. Each O&M Manual shall contain a cover and spine label depicting contents as delineated in paragraph C above; and within each Manual shall be organized in numerical order corresponding to specification sections.
- F. O&M Manuals shall be provided in 3-ring binders similar to close-out manuals described above.
1. O&M manuals shall contain a table of contents listing the specification number with corresponding general description of the material, equipment, and/or assembly included in the manual.
  2. The indexed sections shall be divided and identified by tabbing each section as listed in the index.
- G. Deliverables:
1. Provide electronic copy of all O&M manuals for review. Deliver A/E Consultant O&M Manuals directly to the relative A/E Consultant with a copy of the transmittal to the Architect.
  2. Resubmit as necessary to obtain final acceptance of Manuals.
  3. Once all corrections have been made and the O&M Manuals found to be acceptable, provide one (1) hard copy of each binder and one (1) PDF format electronic copy of each binder to the Architect for transfer to the Owner.

## 2.4 SUBSTANTIAL COMPLETION SCHEDULE

- A. After the date of Substantial Completion of the project as evidenced by the Certificate of Substantial Completion, AIA document G704-2000, the Contractor will be allowed a period of thirty (30) days, unless extended by mutual agreement or provision of the Contract, within which to complete all work and correct all deficiencies contained in the Punch List attached to the Certificate of Substantial Completion. It is incumbent upon the Contractor to request Substantial Completion **only** when there is assurance that all work included on the Punch List shall be completed within the thirty (30) day time frame.
1. In the event the Owner must take occupancy of the project prior to Contractor's completion of the punch list, the Contractor shall make all adjustments necessary to schedule the work to allow full and normal operation of the project by the Owner.
  2. Where this requires work outside of normal business hours, the work shall be provided at no additional cost to the Owner.
- B. Upon Contractor's and sub-contractor's verification that all punch list items have been 100% completed, the Contractor shall notify the Architect and the Architect and consultant(s) shall conduct an on-site observation to verify that all items are 100% complete.
1. On-site verifications for partial completions, if any, shall be conducted by the Architect at the Architect's discretion.
  2. If any items shown to be complete by the Contractor are found not to be complete by the Architect, the observation shall be stopped, with such notification to the Contractor.
  3. Contractor's requested punch list observations by the Architect shall be limited to a maximum of two (2) per punch list.

- C. If the Contractor fails to complete all work on the punch list within thirty (30) days after the Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the punch list items are completed and accepted by the Owner. During this time the Contractor will be charged from the Owner's, Architect's and any A/E Consultant's time associated with achieving completion of the punch list.
1. Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
  2. The weekly meetings shall include a minimum of two (2) hours charge per participant.
- D. Owner billable time shall be deducted from the Contractor's Final Payment or separately invoiced to the Contractor at Owner's option. Owner billable hourly rates shall be as follows:
1. Assistant Superintendent: \$200.00 per hour
  2. Director: \$175.00 per hour
  3. Project Manager: \$150.00 per hour
  4. Project Coordinator: \$120.00 per hour
  5. Administration/Secretarial: \$50.00 per hour
- E. Architect and A/E Consultant billable time shall be invoiced to the Contractor by the Architect. A/E billable rates shall be as follows:
1. A/E Principal: \$175.00 per hour
  2. A/E Project Manager: \$150.00 per hour
  3. Staff Architect/Consultant: \$120.00 per hour
  4. A/E Field Representative: \$100.00 per hour
  5. Administration/Secretarial: \$50.00 per hour

### **PART 3- PRODUCTS**

- 3.1 Not used.

### **PART 4 - CONTRACT CLOSE-OUT**

#### **4.1 GENERAL**

- A. Upon issuance of the (final) Certificate of Substantial Completion, and per the Owner- Contractor Agreement, the Contractor will be allowed a period of ninety (90) days within which to complete all Contract Close-Out requirements, unless extended by mutual agreement or provision of the Contract.
- B. In addition to all work and requirements described for Substantial Completion, in order to achieve Contract Close-Out, the Contractor shall submit all Close-Out documents per Form AO.

#### **Record Document**

- C. Final/ 100% release of retainage will not be authorized by the Architect until the Contractor completes all of the requirements for Contract Close-out; and until all expenses incurred and to be paid by the Contractor have been paid in full.
- D. It is the Contractor's sole responsibility prior to submission to verify that Close-Out documents being submitted for review and acceptance are 100% complete and accurate. The Owner/Architect reserves the right to reject any incomplete close-out documents.
1. Upon discovery by the Architect that Close-Out documents are incomplete and/or inaccurate, the Architect's review shall cease, and the Contractor shall be so notified.

2. The A/E Consultants' will provide a comprehensive list of possible missing and/or incorrect items needed.
- E. It is desirable and beneficial to submit all Close-Out documents as a single submission; however, Close-Out documents may be submitted separately in four (4) deliverables as follows:
1. Close-Out Documents Manual
  2. Operations and Maintenance Manuals (required prior to Substantial Completion)
  3. Record Drawings
  4. Owner's Record Copy of Submittals (one (1) flash drive in PDF format)
- F. Close Out Tracking
1. Contractor shall track the progress of project closeout utilizing excel spreadsheets which will be provided by the Architect (see examples attached at the end of this Spec Section).
  2. Contractor shall update closeout tracking spreadsheets weekly and submit electronic copy to Architect twenty-four hours prior to the weekly closeout review meetings.
  3. Master Closeout Checklist represents all items required to be provided by the Contractor to the Owner at the conclusion of the project. It is more general in nature and only includes a status of the closeout item in question. It does not drill down into the details of when the item was submitted, why it was rejected, when it was approved, etc. This checklist will be used throughout the project to track all closeout deliverables.
  4. Detailed Checklists are more comprehensive lists developed for each section of the closeout requirements. These lists are used by the Contractor to identify and track every deliverable required from each subcontractor. This list will contain a separate entry for each item that is required from each and every subcontractor. It should include the specification section that lists the requirement, a description of the item, responsible subcontractor, and the dates that the items were requested, received, and transmitted to the Owner. The information included in these detailed checklists is used to update the Master Closeout Checklist.
  5. A sample of the Master and Detailed Checklists are attached at the end of this Spec Section. An excel file with the checklists will be provided by Architect.

#### **4.2 CLOSE-OUT MANUALS FORMAT**

- A. All close-out documents shall be submitted in CFISD provided digital format with detailed table of contents, intext tabs corresponding to the table of contents.
1. The close-out documents must be neatly organized and easily useable, as determined by the Architect and Owner.
  2. At completion and final review, submit one (1) electronic PDF file and one (1) flash drive containing close-outs.

## Table of Contents

### Part 1: Close-Out Log

- a. Project Checklist – Form AO
- b. Close Out Log

### Part 2: Project Directory

- a. Project Team (architect, engineer, contractor, consultants)
- b. List of Final Subcontractors/Suppliers/Local Representatives (by Specification Section)

### Part 3: Close-out Documents and Affidavits

- 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

### Part 4: Project Documents and Certificates

- a. AIA G704 - Certificate of Substantial Completion
- b. Punch List / Architects Letter Confirming Completed Punch List
- c. Copy of All Permits
- d. Copy of Final Utility Bill or Letter of Transfer
- e. Certificate of Occupancy
- f. Certification of Project Compliance
- g. Hazardous Material Certificate
- h. Asbestos Manifest / TDLR Inspection / EAB Letter / Structural Letter / Material Testing Letter(s) / Commissioning / other Consultants
- i. Form AQ - Certificate of Final Completion

### Part 5: Warranties (Compiled Sequentially by Specification)

- a. General Contractor's Warranty
- b. Subcontractor's Warranty
- c. Extended Warranties & Maintenance / Service Agreements

### Part 6: Insurance (General Contractor / Subcontractor)

- a. Continued Coverage
- b. Worker's Compensation Certificate

### Part 7: Receipts

- a. Extra Stock by Division
- b. Keys
- c. Paint Mix Cards

### Part 8: Record Documents

- a. Demonstration and Training Sign-in Sheets by Division with Digital Video
- b. Operations & Maintenance Manuals and Record Drawing Transmittal(s)

## 4.3 WARRANTIES

- A. All guarantees and warranties required by the Contract Documents shall establish the date of Substantial Completion as day one (1) of the required warranty period; regardless of how long the product, assembly or work has been installed or in operation prior to Substantial Completion.

1. Coordinate with subcontractors and material suppliers to account for provision in their original proposal/bid amount, if necessary.
- B. Contractor's One-Year Warranty: The Contract requires the General Contractor to warrant ALL materials and work provided/furnished for a period of one (1) year following the date of Substantial Completion.
  1. The one-year general warranty shall include all labor, material and delivery costs required to correct defective material or installation during the Warranty period.
- C. Sub-Contractor's One-Year Warranty: each sub-contractor that performed work on the project shall be required to submit a one-year warranty similar to the above Contractor's One-Year Warranty for their specific work provided.
- D. Extended Warranties: In addition to the General Contractors and subcontractors' one-year warranty, other required guarantees shall be included in the Close-Out Binder in original issue form. All extended warranties shall begin on the Substantial Completion date; and shall include all labor, material and delivery costs required to correct defective material or installation for the entire required extended warranty period, as specified in the respective specification section.

#### 4.4 RECORD DRAWINGS:

- A. Upon Substantial Completion, the Contractor shall be furnished, at no charge, a complete set of electronic files in AutoCAD release 2018 or later, and Revit if applicable, of all drawings included in the Contract Documents. The title blocks shall be stripped of all logos, disclaimers and licensed seals of the Architect and Consultants.
  1. Applicable CTB or plot files shall be furnished by the Architect and each Consultant.
  2. Throughout the construction phase, Architect's and Consultant's supplemental drawings/sketches provided to the Contractor in AutoCAD and Revit format shall be provided to the Contractor electronically and shall be incorporated in the electronic files by the Contractor.
- B. Upon request, the Architect and/or Consultants shall assist the Contractor with understanding the structure and composition of the electronic files to facilitate the generation of the Record Drawings.
- C. The Contractor shall modify the title block on each/every sheet to include only the project name, project address, Owner name, consultants' name and address, date, and clearly identify the set as "Record Drawings".
- D. All electronic Record Drawing work shall be performed in a professional manner using AutoCAD and Revit, as applicable, and shall maintain the format/structure/composition of the original Contract Document drawings.
- E. All modifications, additions, deletions, and revisions made to the project during the construction phase shall be reflected on the Record Drawings; and shall include, but not necessarily limited to:
  1. All as-built dimensions (different than original dimensions)
  2. All as-built locations and conditions relative to underground plumbing, sanitary and storm piping installations, natural gas piping and electrical conduits; shown accurately to within twelve (12) inches. Notes shall indicate approximate depth of all underground piping and utilities.
  3. All as-built conditions relative to ductwork installations; shown accurately to within six (6) inches.
  4. All as-built conditions relative to HVAC water piping installations; shown accurately to within six (6) inches.
  5. All as-built conditions relative to underground electrical conduit installations. shown accurately to within six (6) inches.
  6. Record drawings shall include a copy of fire sprinkler layout of piping and equipment.



7. All approved CPR's resulting in a physical change in the work.
  8. All RFI's resulting in a physical change in the work.
  9. All AEA's resulting in a physical change in the work.
  10. All Minor Changes resulting in a physical change in the work.
  11. All Construction Change Directives resulting in a physical change in the work.
  12. Update the list of drawings as necessary to reflect added and deleted sheets.
- F. All modifications shall be represented by actually deleting the original work and accurately depicting the revised as-built modifications/configurations. "X-ing out" deleted work shall not be accepted.
- G. Upon completion of all revisions to the Record Drawings, including the Architect's acceptance, the Record Drawings shall be copied to a thumb drive or solid-state media drive maintaining the exact folder/file structure originally furnished to the Contractor. Submit to the Architect for review before proceeding with deliverables.
- H. Deliverables: Upon Deliverables: review and acceptance of the documentation, including format, the Architect shall direct the Contractor to proceed with delivery of the following:
1. Three (3) thumb drives or solid-state media drives, containing the entire set of Record Drawings in PDF and TIFF format. Each sheet shall be a separate PDF and TIFF file. The thumb drives shall be organized to duplicate the order of drawings as they were issued for bidding and construction, with record drawing modifications.
  2. Three (3) thumb drives or solid-state media drives, containing the entire set of Record Drawings in AutoCAD and Revit format as applicable. Each sheet shall be a separate AutoCAD or Revit file. The thumb drives shall be organized to duplicate the order of drawings as they were issued for bidding and construction, with record drawing modifications.

#### **4.5 RECORD SUBMITTALS**

- A. The Contractor shall maintain and submit a separate set of final submittals to be delivered to the Owner as a condition of Contract Close-Out.
- B. Include only the final version of each submittal, including all submittal review comment sheets from the Architect and Consultant. Versions of submittals that were rejected or required to be revised and resubmitted are not required.
- C. Deliverables:
1. Deliver one (1) hard copy set of Record Submittals in file boxes, organized in order by specification division, with tabs included for each section of specifications and submittal log of contents of each file box.
  2. Deliver three (3) copies of all Record Submittals in PDF electronic format on three (3) thumb drives or solid-state media drives.

#### **4.6 RECORD SPECIFICATIONS/PROJECT MANUAL**

- A. The Contractor shall submit a record copy of specifications in hard copy and also in Microsoft Word electronic format on thumb drive or solid-state media drive. Record specifications shall be edited to contain only actual manufacturers, products, colors and model numbers actually used in the project.

#### **4.7 CONTRACT CLOSE-OUT SCHEDULE**

- A. If the Contractor fails to complete requirements of Contract Close-Out within sixty (60) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the Close-Out documents are completed and accepted by the Owner. During this time the Contractor will be charged for the Owner's, Architect's and any A/E Consultant's time associated with achieving Final Completion.

1. Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
  2. The weekly meetings shall include a minimum of two (2) hours charge per participant.
  3. Refer to A201 – for Owner and Architect/A&E/Consultants billable times.
- B. In scheduling submission(s) and final approvals of Close-Out documents, the Contractor shall allow for the following review period for each submission:
1. Architect: Ten (10) calendar days
  2. Architect's Consultant: Twelve (12) calendar days.
- C. Additionally, failure by the Contractor to complete Contract Close-Out within the stipulated time will be reported to the Contractor's surety. In the report of deficiency, the Contractor and surety will be informed that, should correction work remain incomplete for fifteen (15) additional days, the Owner at his discretion may initiate action to complete corrective work out of the remaining contract funds in accordance with the Owner-Contractor Agreement, General and Supplementary Conditions to the Agreement as they apply.
1. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete Contract Close-Out within sixty (60) days after the date of Substantial Completion, unless extended by mutual agreement or provision of the contract, will be deducted from the funds remaining to be paid to the Contractor.

#### **4.8 WARRANTY INSPECTION**

- A. Approximately six months after substantial completion and at one (1) month prior to expiration of the one-year guarantee period, the Contractor shall notify the Architect and Owner to schedule an inspection of the work in the company of the Architect and the Owner. The Architect and the Owner shall be given not less than ten (10) days' notice prior to the anticipated date of warranty inspection.
- B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Architect and the Owner, even though the date of completion of the corrective work may extend beyond the expiration date of the guarantee period.
- C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner, nor the replacement of parts necessitated by normal wear in use.

**END OF SECTION**

## **SECTION 01 91 00**

### **GENERAL COMMISSIONING REQUIREMENTS**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. 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**

- A. 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.
- B. 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.
- C. 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.
- D. 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:
- E. Verify and document proper installation and intended performance of equipment, systems, and integrated systems.
- F. Ensure that operating and maintenance and Commissioning documentation requirements are complete.
- G. 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**

- A. 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.
- B. 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.

- C. 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.
- D. 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.
- E. 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.).
- F. 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.
- G. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Project Documents.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. 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.
- M. 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.
- N. 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.

- O. 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.
- P. 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).
- Q. 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.
- R. 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**

- A. Owner shall appoint the following Members:
  - 1) Owner's Project Manager and any other designated representatives of the Owner's staff.
  - 2) Commissioning Authority (CxA)
  - 3) Architect/Engineer (A/E)
  - 4) Test, Adjust and Balance Firm (TAB) – may be sub-contracted to the CxA
- B. Contractor shall appoint the following Members:
  - 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.
  - 2) Vendor representatives (as needed) required for start-up, operational testing, Functional Performance Testing, Integrated Systems Testing, and Owner Training activities.
  - 3) Representatives of independent testing agencies (Test, Adjust and Balance, Electrical Testing Agency, etc.)

#### **1.5 ROLES AND RESPONSIBILITIES**

- A. 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.
- B. Owner's Roles and Responsibilities:

- 1) Provide guidance in development of the Owner's Project Requirements (OPR).
  - 2) Review Technical Specifications containing Commissioning requirements.
  - 3) Approve the Commissioning Scope of Work and schedule of Commissioning activities.
  - 4) Assign Owner's representatives and schedule them to participate in Commissioning activities, including the following:
    - a. Commissioning Team meetings.
    - b. 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.
    - c. Attend Owner Training sessions in operation and maintenance of systems and equipment.
    - d. Observation of Contractor's demonstration of systems and equipment operation.
- C. Commissioning Authority's (CxA) Roles and Responsibilities:
- 1) Prepare the Commissioning Plan with the Owner's and Contractor's review and input.
  - 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.
  - 3) Conduct and document Commissioning Team meetings including the Commissioning Kickoff Meeting.
  - 4) Perform site visits as necessary to observe component and system installations prior to energizing or start-up of equipment and systems.
  - 5) Review and comment on product data and shop drawing submittals and coordination drawings applicable to systems being commissioned.
  - 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.
  - 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.
  - 8) Witness, verify, and document results of Functional Performance Tests and Integrated Systems Tests.
  - 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.

- 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.
- 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.
- 12) Compile the Final Commissioning Process Report and submit to the Owner for review and approval.

D. Architect/Engineer's (A/E) Roles and Responsibilities:

- 1) Specify control sequences of operation within the Contract Documents that comply with the OPR and BOD.
- 2) Incorporate Commissioning requirements into the Contract Documents if requested by the Owner.
- 3) Attend Commissioning Team meetings.
- 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.
- 5) Review Contractor's Training Plan and provide comments to the Owner.
- 6) Approve technical requirements for correction of Deficiencies identified during Commissioning, Deferred Tests, and during the warranty period.
- 7) Review Operating and Maintenance Manuals and provide comments to the Owner.

E. Contractor's Roles and Responsibilities:

- 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.
- 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.
- 3) Furnish and install systems that meet all requirements of the Contract Documents.
- 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.
- 5) Submit inspection requests, start-up requests and all supporting documentation in accordance with

the Contract Documents, General Conditions, and Commissioning Plan.

- 6) Cooperate with Owner's representative(s), provide access to work and provide adequate labor, resources, and time for Commissioning.
- 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.
- 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.
- 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.
- 10) Correct deficiencies identified during any stage of the Commissioning process.
- 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.
- 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.
- 13) Perform system maintenance during construction as specified and recommended by the Owner and send the maintenance records to the Owner for Record.
- 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.
- 3.12.4. 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**





PROJECT  
MANUAL  
**VOLUME 2**

JANUARY 20, 2025



**2024 Cy-Creek HS Renovations**  
**CYPRESS-FAIRBANKS ISD**  
**HOUSTON, TEXAS**

OWNER:



INDEPENDENT SCHOOL DISTRICT

11440 Matzke Rd.

Cypress, Texas 77429

VLK Project No.

23-148.00

Cypress-Fairbanks  
Project No.  
24-02-5754-R-RFP



OWNER

**Cypress-Fairbanks  
Independent School District**

11440 Matzke Rd.

Cypress, Texas 77429

**PROJECT  
MANUAL  
VOLUME 2**

JANUARY 20, 2025

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01/20/2025

CIVIL ENGINEER

**Brooks & Sparks, Inc.**

Firm Registration Number: F-880

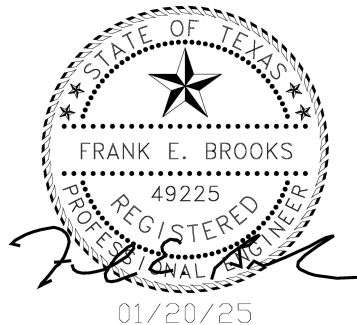
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01/20/25

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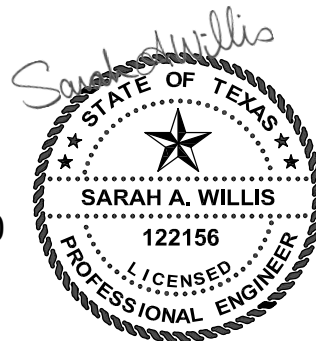
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1/20/25

**2024 Cy-Creek HS Renovations  
CYPRESS-FAIRBANKS ISD  
HOUSTON, TEXAS**

VLK Project No.

23-148.00

Cypress-Fairbanks  
Project No.  
24-02-5754-R-RFP

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ACOUSTICAL / THEATRICAL

**WJHW, Inc.**

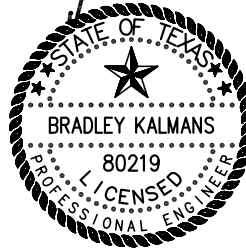
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*Bradley Kalmans*



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JANUARY 20, 2025

**2024 Cy-Creek HS Renovations**  
**CYPRESS-FAIRBANKS ISD**  
**HOUSTON, TEXAS**

VLK Project No.

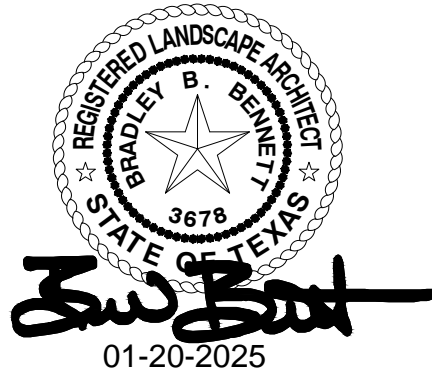
23-148.00

Cypress-Fairbanks  
Project No.  
24-02-5754-R-RFP

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MANUAL  
**VOLUME 2**

JANUARY 20, 2025

**2024 Cy-Creek HS Renovations**  
**CYPRESS-FAIRBANKS ISD**  
**HOUSTON, TEXAS**

VLK Project No.

23-148.00

Cypress-Fairbanks  
Project No.  
24-02-5754-R-RFP





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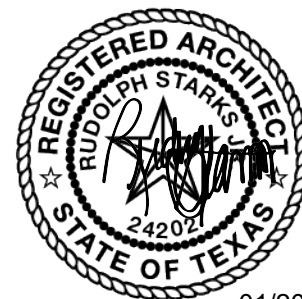
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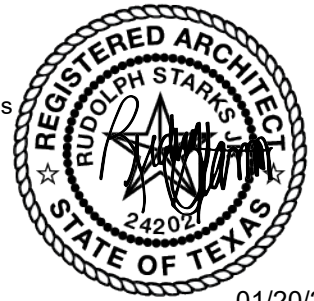
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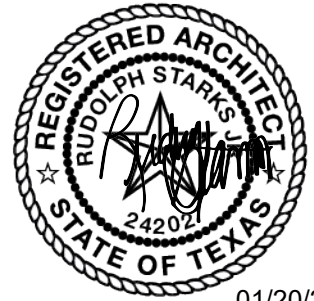
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SECTION 02 41 13.10

REMOVING EXISTING PAVEMENT AND STRUCTURES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

**PART 1**    G E N E R A L

1.1        SECTION INCLUDES

- A.        Removing concrete paving, asphaltic concrete pavement, and base courses.
- B.        Removing concrete curbs, concrete curbs and gutters, sidewalks, and driveways.
- C.        Removing pipe culverts and sewers.
- D.        Removing existing inlets and manholes.
- E.        Removing miscellaneous structures of concrete or masonry.

1.2        MEASUREMENT AND PAYMENT

- A.        Unit Prices:
  - 1.        Payment for removing and disposing of asphaltic surfacing and unreinforced concrete base under asphaltic surfacing, regardless of the thickness encountered, is on a square yard basis measured between lips of gutters.
  - 2.        Payment for removing and disposing of concrete base under surfacing with curbs, regardless of the thickness encountered, is on a square yard basis measured from back-to-back of curbs. Payment includes removal of all concrete base, asphaltic surfacing, concrete pavement, esplanade curbs, curb and gutters, and paving headers.
  - 3.        Payment for removing and disposing of reinforced concrete pavement, regardless of its thickness, is on a square yard basis measured from back-to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.
  - 4.        Payment for removing and disposing of monolithic curbs and gutters, and concrete curbs, is on a linear foot basis measured along the face of the curb.
  - 5.        Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on a square yard basis.
  - 6.        Payment for removing and disposing of concrete sidewalks is on a square yard basis.
  - 7.        Payment for removing and disposing of concrete driveways is on a square yard basis.
  - 8.        Payment for removing and disposing of miscellaneous concrete and masonry is on a cubic yard basis of the structure in place.
  - 9.        Payment for removing and disposing of pipe culverts and sewers is on a linear foot basis for each diameter and each material type of pipe removed.
  - 10.       Payment for removing and disposing of existing inlets is on a unit price basis for each inlet removed.
  - 11.       Payment for removing and disposing of existing manholes is on a unit price basis for each manhole removed.
  - 12.       Payment for saw cutting of existing pavement is on a linear foot basis.
  - 13.       No payment will be made for work removed without the Engineer's approval or for pavements or structures removed for the Contractor's convenience.
- B.        Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3        REGULATORY REQUIREMENTS

- A.        Conform to applicable codes for disposal of debris.
- B.        Coordinate removal work with utility companies.

**PART 2**    P R O D U C T S – Not Used

### **PART 3    E X E C U T I O N**

#### **3.1            P R E P A R A T I O N**

- A.        Obtain advance approval from Engineer for dimensions and limits of removal work.
- B.        Identify known utilities below grade. Stake and flag locations.

#### **3.2            P R O T E C T I O N**

- A.        Protect the following from damage or displacement:
  - 1.        Adjacent public and private property.
  - 2.        Trees, plants, and other landscape features designated to remain.
  - 3.        Utilities designated to remain.
  - 4.        Pavement and utility structures designated to remain.
  - 5.        Bench marks, monuments, and existing structures designated to remain.

#### **3.3            R E M O V A L S**

- A.        Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.
- B.        Minimize amount of earth loaded during removal operations.
- C.        Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of two (2) inches.
- D.        Where street and driveway saw cut locations coincide or fall within three (3) feet of existing construction or expansion joints, break out to existing joint.
- E.        Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.
- F.        Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch thick masonry plug in pipe end prior to backfill.

#### **3.4            B A C K F I L L**

- A.        Backfill of removal areas shall be in accordance with requirements of Division 31.

#### **3.5            D I S P O S A L**

- A.        Inlet frames, grates, plates, and manhole frames and covers may remain property of the Owner. Disposal shall be in accordance with requirements of Section 02 41 13.11 – Construction Waste Management and Disposal.
- B.        Remove from the site debris resulting from work under this section in accordance with requirements of Section 02 41 13.11 - Construction Waste Management and Disposal.

END OF SECTION

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Taking down, cutting away, breaking out and removing portions of the existing 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 02 50 00

SITE RESTORATION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Payment for restoration of Project site disturbed by utility construction operations is on a linear foot basis. Measurement will be as provided for corresponding utility in each Specification section. No separate payment made for branch pipe, valves and, other associated work for utilities. Measurement for restoration with multiple utilities within the same right-of-way will be on a linear foot basis for only one utility.
  - 2. No separate payment made for facility or roadway projects. Include cost in the surface improvements associated with the facility or roadway construction.
  - 3. Payment includes required site restoration within the right-of-way or easement regardless of size or type of pipe, method of construction, paved or unpaved areas or thickness and width of pavement.
  - 4. No separate payment made for site restoration for service connections under this Section. Include cost in appropriate utility section.
  - 5. Refer to Division 1 for Unit Price procedures.
- B. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this section in total Stipulated Price.

1.3 DEFINITIONS

- A. Phase: Locations identified on the plans and listed in Division 1.
- B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.
- C. Site Improvement: Includes pavement, curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Schedule of testing, service connections, abandonment, backfill, and site restoration.
- C. Sample of notices to residents outlining their responsibility for maintenance of site improvements adjacent to the Project that are not disturbed by construction operations.

1.5 SCHEDULING

- A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of pipe laying work or paving within each block or line segment.
- B. Phased Construction:
  - 1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.



C. Construction of Projects with no Phases listed in Division 1:

1. Complete site restoration prior to disturbing over 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way or easement.
2. Limit work to a maximum of 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way and easement. Commence work in additional right-of-way or easement after completion of site restoration.

PART 2 P R O D U C T S

2.1 MATERIALS

- A. Pavement, Sidewalks and Driveways: Materials specified in Division 2.
- B. Seeding and Sodding: Sod specified in Division 2.
- C. Trees, Shrubs and Plantings: Conform to requirements of Division 1.

PART 3 E X E C U T I O N

3.1 PREPATORY WORK

- A. Provide cleanup and restoration crews to work closely behind pipe laying and roadway construction crews, and where necessary, during testing, service restoration, abandonment, backfill and surface restoration.
- B. Water Lines: Unless otherwise approved by Owner's Representative, comply with the following:
  1. Once Owner's Representative approves work within a Phase, immediately begin preparatory work for disinfection effort.
  2. No later than three days after completing disinfection preparatory work, initiate disinfection work.
  3. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
- C. Wastewater Lines:
  1. Once Owner's Representative approves work within a Line Segment, immediately begin preparatory work for testing effort.
  2. No later than three days after completing preparatory work for testing, initiate testing work.
  3. Immediately after transfer of service connections, begin abandonment of old wastewater lines, and site restoration.
- D. Street Construction and Paving Projects
  1. Once Owner's Representative approves work within a Line Segment or block, immediately begin preparatory work for testing effort.
  2. No later than three days after completing preparatory work for testing, initiate testing work.
  3. Immediately after testing begin site restoration.
- E. Street Construction and Paving Projects
  1. Once Owner's Representative approves work within a block, immediately begin preparatory work for sidewalk construction, sodding and hydromulching and tree planting.
  2. No later than seven days after completing preparatory work, initiate construction.

3.2 CLEANING

- A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Division 1.

3.3 LANDSCAPING AND FENCES

A. Seeding and Sodding.

1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.
2. Restore previously existing turfed areas with sod and fertilize in accordance with Division 2. Sod to match existing turf.
3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Division 2.

B. Trees, Shrubbery and Plants.

1. Remove and replant trees, shrubs, and plants in accordance with requirements of Division 1.

C. Fence Replacement.

1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work as determined by owner representative, may be reused.
2. Remove and dispose of damaged or substandard material.

3.4 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas.

B. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

C. Refer to Division 1 and Division 2 for maintenance requirements.

D. Notify Owner's Representative 10 days before end of maintenance period for inspection and acceptance.

END OF SECTION

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**SECTION 031000**  
**CONCRETE FORMING AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
1. Form-facing material for cast-in-place concrete.
  2. Shoring, bracing, and anchoring.
- B. Related Requirements:
1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.
  2. Section 321316 "Decorative Concrete Paving" for formwork related to decorative concrete pavement and walks.

**1.3 DEFINITIONS**

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review the following:
    - a. Special inspection and testing and inspecting agency procedures for field quality control.
    - b. Construction, movement, contraction, and isolation joints
    - c. Forms and form-removal limitations.
    - d. Anchor rod and anchorage device installation tolerances.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each of the following:
1. Exposed surface form-facing material.
  2. Concealed surface form-facing material.
  3. Form ties.
  4. Waterstops.
  5. Form-release agent.
- B. Sustainable Design Submittals:
1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer (post-industrial) recycled content per unit of product.
    - a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
    - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
    - c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.

- d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
  - 2. Product Data for Credit MR 5.1 and Credit MR 5.2 For local and regional material extracted/harvested and manufactured within a 500 mile radius from the project site.
    - a. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
    - b. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
    - c. Indicate dollar value of product containing local/regional materials; include materials cost only.
    - d. Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
  - 1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
  - 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
    - a. Location of construction joints is subject to approval of the Architect.
  - 3. Indicate location of waterstops.
- D. Samples:
  - 1. For waterstops.

#### **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing and inspection agency.
- B. Field quality-control reports.
- C. Minutes of preinstallation conference.

#### **1.7 QUALITY ASSURANCE**

- A. Testing and Inspection Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
  - 1. Build panel as directed by Architect.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
  - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
  - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

#### **2.2 FORM-FACING MATERIALS**

- A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
  - a. Plywood, metal, or other approved panel materials.
  - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - 1) APA HDO (high-density overlay).
    - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
    - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
    - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.
- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
  1. Provide lumber dressed on at least two edges and one side for tight fit.

## **2.3 WATERSTOPS**

- A. Flexible Rubber Waterstops: U.S. Army Corps of Engineers CRD-C 513 for embedding in concrete to prevent passage of fluids through joints, with factory fabricated corners, intersections, and directional changes.
  1. Profile: As indicated
- B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
- C. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

## **2.4 RELATED MATERIALS**

- A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch , minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  2. Form release agent for form liners shall be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.
- C. Limit concrete surface irregularities as follows:
  - 1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
  - 1. Minimize joints.
  - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
  - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
  - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
  - 1. Provide and secure units to support screed strips
  - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
  - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
  - 2. Locate temporary openings in forms at inconspicuous locations.
- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than **12 inches**
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
  - 1. Determine sizes and locations from trades providing such items.
  - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
  - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
  - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 3. Place joints perpendicular to main reinforcement.
  - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
    - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 6. Space vertical joints in walls as indicated on Drawings.
    - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
  - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
  - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.2 INSTALLATION OF EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
  - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
  - 5. Clean embedded items immediately prior to concrete placement.

### **3.3 INSTALLATION OF WATERSTOPS**

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
  - 1. Install in longest lengths practicable.
  - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
  - 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-In-Place Concrete."
  - 4. Secure waterstops in correct position at 12 inches on center.
  - 5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
    - a. Miter corners, intersections, and directional changes in waterstops.
    - b. Align center bulbs.
  - 6. Clean waterstops immediately prior to placement of concrete.
  - 7. Support and protect exposed waterstops during progress of the Work.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
  - 1. Install in longest lengths practicable.
  - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
  - 3. Protect exposed waterstops during progress of the Work.

### **3.4 REMOVING AND REUSING FORMS**

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
  - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.



2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
  1. Align and secure joints to avoid offsets.
  2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

**3.5 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

**END OF SECTION 031000**

**SECTION 032000**  
**CONCRETE REINFORCING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
1. Steel reinforcement bars.
  2. Welded-wire reinforcement.
- B. Related Requirements:
1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
  2. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

**1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review the following:
    - a. Special inspection and testing and inspecting agency procedures for field quality control.
    - b. Construction contraction and isolation joints.
    - c. Steel-reinforcement installation.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For the following:
1. Each type of steel reinforcement.
  2. Zinc repair material.
  3. Bar supports.
  4. Mechanical splice couplers.
- B. Sustainable Design Submittals:
1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer (post-industrial) recycled content per unit of product.
    - a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
    - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
    - c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
    - d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
  2. Product Data for Credit MR 5.1 and Credit MR 5.2 For local and regional material extracted/harvested and manufactured within a 500 mile radius from the project site.
    - a. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
    - b. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.

- c. Indicate dollar value of product containing local/regional materials; include materials cost only.
  - d. Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. Shop Drawings: Comply with ACI SP-066:
  - 1. Include placing drawings that detail fabrication, bending, and placement.
  - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
  - 3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.
- D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
  - 1. Location of construction joints is subject to approval of the Architect.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Statements: For testing and inspection agency.
- B. Welding certificates.
  - 1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Steel Reinforcement:
    - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
  - 2. Mechanical splice couplers.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

## **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
  - 1. Store reinforcement to avoid contact with earth.

# **PART 2 - PRODUCTS**

## **2.1 STEEL REINFORCEMENT**

- 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer (post-industrial) recycled content per unit of product.
  - a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
  - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
  - c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
  - d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- B. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

- C. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- D. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- E. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.
- F. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- H. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

## **2.2 REINFORCEMENT ACCESSORIES**

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- C. Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced; tension-compression type, dowel-bar type, mechanical-lap type.
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
  - 1. Finish: Galvanized ASTM A884/A884M, Class A, Type 1.

## **2.3 FABRICATING REINFORCEMENT**

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

# **PART 3 - EXECUTION**

## **3.1 PREPARATION**

- A. Protection of In-Place Conditions:
  - 1. Do not cut or puncture vapor retarder.
  - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

## **3.2 INSTALLATION OF STEEL REINFORCEMENT**

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
  - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
  - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
  - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
  - 2. Stagger splices in accordance with ACI 318.
  - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.

4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install structural thermal break insulated connection system in accordance with manufacturer's instructions.
- H. Install welded-wire reinforcement in longest practicable lengths.
  1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
    - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
  2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
  3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
  4. Lace overlaps with wire.

### **3.3 JOINTS**

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  1. Place joints perpendicular to main reinforcement.
  2. Continue reinforcement across construction joints unless otherwise indicated.
  3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

### **3.4 INSTALLATION TOLERANCES**

- A. Comply with ACI 117.

### **3.5 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  1. Steel-reinforcement placement.
  2. Steel-reinforcement mechanical splice couplers.
  3. Steel-reinforcement welding.
- D. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

**END OF SECTION 032000**

**SECTION 033000**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
  - 2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

**1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

**1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special concrete finish Subcontractor.
  - 2. Review the following:
    - a. Special inspection and testing and inspecting agency procedures for field quality control.
    - b. Construction joints, control joints, isolation joints, and joint-filler strips.
    - c. Semirigid joint fillers.
    - d. Vapor-retarder installation.
    - e. Anchor rod and anchorage device installation tolerances.
    - f. Cold and hot weather concreting procedures.
    - g. Concrete finishes and finishing.
    - h. Curing procedures.
    - i. Forms and form-removal limitations.
    - j. Methods for achieving specified floor and slab flatness and levelness.
    - k. Floor and slab flatness and levelness measurements.
    - l. Concrete repair procedures.
    - m. Concrete protection.
    - n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
    - o. Protection of field cured field test cylinders.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each of the following.

1. Portland cement.
  2. Fly ash.
  3. Aggregates.
  4. Admixtures:
    - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
  5. Vapor retarders.
  6. Floor and slab treatments.
  7. Liquid floor treatments.
  8. Curing materials.
  9. Joint fillers.
  10. Repair materials.
- B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
  2. Minimum 28-day compressive strength.
  3. Durability exposure class.
  4. Maximum w/cm.
  5. Calculated equilibrium unit weight, for lightweight concrete.
  6. Slump limit.
  7. Air content.
  8. Nominal maximum aggregate size.
  9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
  10. Intended placement method.
  11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings:
1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
    - a. Location of construction joints is subject to approval of the Architect.
- D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.
  2. Location within Project.
  3. Exposure Class designation.
  4. Formed Surface Finish designation and final finish.
  5. Final finish for floors.
  6. Curing process.
  7. Floor treatment if any.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For the following:
1. Installer: Include copies of applicable ACI certificates.
  2. Ready-mixed concrete manufacturer.
  3. Testing agency: Include copies of applicable ACI certificates.
- B. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
  2. Admixtures.
  3. Curing compounds.

4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency:
  1. Portland cement.
  2. Fly ash.
  3. Aggregates.
  4. Admixtures:
- D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.
- E. Research Reports:
  1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
  2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.
- F. Preconstruction Test Reports: For each mix design.
- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

#### **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete.
  1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
  1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
  1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.
- E. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
  1. Formed Surfaces: Build panel as directed by Architect.

#### **1.8 PRECONSTRUCTION TESTING**

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
  1. Include the following information in each test report:



- a. Admixture dosage rates.
- b. Slump.
- c. Air content.
- d. Seven-day compressive strength.
- e. 28-day compressive strength.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with ASTM C94/C94M and ACI 301.

## **1.10 FIELD CONDITIONS**

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
  - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 3. Do not use frozen materials or materials containing ice or snow.
  - 4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
  - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
  - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## **1.11 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

### **2.2 CONCRETE MATERIALS**

- A. Source Limitations:
  - 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
  - 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
  - 3. Obtain aggregate from single source.
  - 4. Obtain each type of admixture from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C150/C150M, Type I/II
  - 2. Fly Ash: ASTM C618, Class C or F.
- C. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Alkali-Silica Reaction: Comply with one of the following:

- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
- 2. Maximum Coarse-Aggregate Size: Per Construction Documents.
- 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C330/C330M, maximum nominal aggregate size per Construction Documents.
- E. Air-Entraining Admixture: ASTM C260/C260M.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- G. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments, color stable, **free of carbon black**, nonfading, and resistant to lime and other alkalis.
  - 1. Color: As selected by Architect from manufacturer's full range.
- H. Water and Water Used to Make Ice: ASTM C94/C94M, potable

### 2.3 VAPOR BARRIERS

- A. Refer to section 07 26 16 "Under Slab Vapor Barrier"

### 2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ChemMasters; Chemisil Plus.
    - b. ChemTec Int'l; ChemTec One.
    - c. Conspec by Dayton Superior; Intraseal.
    - d. Curecrete Distribution Inc.; Ashford Formula.
    - e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
    - f. Edoco by Dayton Superior; Titan Hard.
    - g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
    - h. Kaufman Products, Inc.; SureHard.
    - i. L&M Construction Chemicals, Inc.; Seal Hard.
    - j. Meadows, W. R., Inc.; LIQUI-HARD.
    - k. Metalcrete Industries; Floorsaver.
    - l. Nox-Crete Products Group; Duro-Nox.
    - m. Symons by Dayton Superior; Buff Hard.
    - n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
    - o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
  - 1. Color:
    - a. Ambient Temperature Below 50 deg F: Black.
    - b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
    - c. Ambient Temperature Above 85 deg F: White.
- D. Water: Potable or complying with ASTM C1602/C1602M.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
    - b. BASF Construction Chemicals - Building Systems; Kure 200.
    - c. ChemMasters; Safe-Cure Clear.
    - d. Conspec by Dayton Superior; W.B. Resin Cure.
    - e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
    - f. Edoco by Dayton Superior; Res X Cure WB.
    - g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
    - h. Kaufman Products, Inc.; Thinfilm 420.
    - i. Lambert Corporation; AQUA KURE - CLEAR.
    - j. L&M Construction Chemicals, Inc.; L&M Cure R.
    - k. Meadows, W. R., Inc.; 1100-CLEAR.
    - l. Nox-Crete Products Group; Resin Cure E.
    - m. Right Pointe; Clear Water Resin.
    - n. SpecChem, LLC; Spec Rez Clear.
    - o. Symons by Dayton Superior; Resi-Chem Clear.
    - p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
    - q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
- F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Construction Chemicals - Building Systems; Kure 1315.
    - b. ChemMasters; Polyseal WB.
    - c. Conspec by Dayton Superior; Sealcure 1315 WB.
    - d. Edoco by Dayton Superior; Cureseal 1315 WB.
    - e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
    - f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
    - g. Lambert Corporation; UV Safe Seal.
    - h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
    - i. Meadows, W. R., Inc.; Vocomp-30.
    - j. Metalcrete Industries; Metcure 30.
    - k. Right Pointe; Right Sheen WB30.
    - l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
    - m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

## 2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.

- C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## **2.6 REPAIR MATERIALS**

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C109/C109M.

## **2.7 CONCRETE MIXTURES, GENERAL**

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
  - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
  - 2. Slag Cement: 50 percent by mass.
  - 3. Silica Fume: 10 percent by mass.
  - 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
  - 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
  - 1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete for parking structure slabs, and concrete with a w/cm below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Use permeability-reducing admixture in concrete mixtures where indicated.
- D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## **2.8 NON-SHRINK GROUT**

- A. Grout shall be prepackaged, non metallic, and non gaseous. It shall be non-shrink when tested in accordance with ASTM-C1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds. Thirty-minute-old grout shall flow through the flow cone after slight agitation, in temperatures of 40 degrees to 90 degrees Fahrenheit. Grout shall be bleed free and attain 7,500 psi compressive strength in 28 days at fluid consistency. Certified independent test data required. Approved products include the following:
  1. "Euco NS" by Euclid Chemical Company
  2. "Masterflow 713" by Master Builders.

## **2.9 CONCRETE MIXTURES**

- A. See Construction Documents for requirement and locations.

## **2.10 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116, and furnish batch ticket information.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Verification of Conditions:
  1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
  2. Do not proceed until unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
  1. Daily access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
  4. Security and protection for test samples and for testing and inspection equipment at Project site.

## **3.3 INSTALLATION OF EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
  3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  - 2. Face laps away from exposed direction of concrete pour.
  - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
  - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
  - 7. Protect vapor retarder during placement of reinforcement and concrete.
    - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

### 3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  - 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  - 2. Place joints perpendicular to main reinforcement.
    - a. Continue reinforcement across construction joints unless otherwise indicated.
    - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
  2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

### **3.6 CONCRETE PLACEMENT**

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
  2. Deposit concrete to avoid segregation.
  3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
  2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  3. Maintain reinforcement in position on chairs during concrete placement.
  4. Screed slab surfaces with a straightedge and strike off to correct elevations.

5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

### 3.7 FINISHING FORMED SURFACES

#### A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
  - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
  - b. Remove projections larger than 1 inch.
  - c. Tie holes do not require patching.
  - d. Surface Tolerance: ACI 117 Class D.
  - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
  - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - b. Remove projections larger than 1/4 inch.
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117 Class B.
  - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
3. ACI 301 Surface Finish SF-3.0:
  - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
  - b. Remove projections larger than 1/8 inch.
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117 Class A.
  - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

#### B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:
  - a. Perform no later than one day after form removal.
  - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
  - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
  - d. Maintain required patterns or variances as shown on Drawings
2. Grout-Cleaned Rubbed Finish:
  - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
  - b. Do not clean concrete surfaces as Work progresses.
  - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
  - d. Wet concrete surfaces.
  - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
  - f. Maintain required patterns or variances as shown on Drawings



3. Cork-Floated Finish:
  - a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
  - b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
  - c. Wet concrete surfaces.
  - d. Compress grout into voids by grinding surface.
  - e. In a swirling motion, finish surface with a cork float.
  - f. Maintain required patterns or variances as shown on Drawings
4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi (6.9 to 10.3 MPa), apply scrubbed finish.
  - a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed and aggregate is uniformly exposed.
  - b. Rinse scrubbed surfaces with clean water.
  - c. Maintain continuity of finish on each surface or area of Work.
  - d. Remove only enough concrete mortar from surfaces to match field sample panels.
- C. Related Unformed Surfaces:
  1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
  2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### **3.8 FINISHING FLOORS AND SLABS**

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
  1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
  2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
  3. Apply scratch finish to surfaces to receive concrete floor toppings, to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish:
  1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
  2. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
  3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish:
  1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
  2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
  3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  4. Do not add water to concrete surface.

5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
  - a. Slabs on Ground:
    - 1) Specified overall values of flatness,  $F_F$  35; and of levelness,  $F_L$  25; with minimum local values of flatness,  $F_F$  24; and of levelness,  $F_L$  17.
    - 2) At the black box area, floor flatness shall be  $F_F$  50 and levelness  $F_L$  37
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
  1. Coordinate required final finish with Architect before application.
  2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
  1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
  2. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish to concrete stair treads, platforms, ramps as indicated on Drawings
  1. Apply in accordance with manufacturer's written instructions and as follows:
    - a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate or aluminum granules over surface in one or two applications.
    - b. Tamp aggregate flush with surface, but do not force below surface.
    - c. After broadcasting and tamping, apply float finish.
    - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

### 3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
  1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
  2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
  3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings.
  3. Minimum Compressive Strength: 3500 psi at 28 days.
  4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
  6. Prior to pouring concrete, place and secure anchorage devices.

- a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - b. Cast anchor-bolt insert into bases.
  - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
  - 1. Cast-in inserts and accessories, as shown on Drawings.
  - 2. Screed, tamp, and trowel finish concrete surfaces.

### **3.10 CONCRETE CURING**

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
  - 2. Comply with ACI 301 and ACI 305. for hot-weather protection during curing.
  - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
  - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
  - 3. If forms remain during curing period, moist cure after loosening forms.
  - 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
      - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
      - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
  - 1. Begin curing immediately after finishing concrete.
  - 2. Interior Concrete Floors:
    - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
        - a) Lap edges and ends of absorptive cover not less than 12-inches.
        - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
      - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.

- a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
    - b) Cure for not less than seven days.
  - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
    - a) Water.
    - b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
  - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
    - a) Lap edges and ends of absorptive cover not less than 12 inches.
    - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
  - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
    - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
    - b) Cure for not less than seven days.
  - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
    - a) Water.
    - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
  - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
    - a) Lap edges and ends of absorptive cover not less than 12 inches.
    - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
  - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
    - a) Water.
    - b) Continuous water-fog spray.
- d. Floors to Receive Curing Compound:
  - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Maintain continuity of coating, and repair damage during curing period.
  - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- e. Floors to Receive Curing and Sealing Compound:

- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### **3.11 TOLERANCES**

- A. Conform to ACI 117.

### **3.12 JOINT FILLING**

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
  1. Defer joint filling until concrete has aged at least one month.
  2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

### **3.13 CONCRETE SURFACE REPAIRS**

- A. Defective Concrete:
  1. Repair and patch defective areas when approved by Architect.
  2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.
    - a. Limit cut depth to 3/4 inch.
    - b. Make edges of cuts perpendicular to concrete surface.
    - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    - d. Fill and compact with patching mortar before bonding agent has dried.
    - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
    - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    - b. Compact mortar in place and strike off slightly higher than surrounding surface.
  3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces:
  1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
    - a. Correct low and high areas.
    - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that

- penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
3. After concrete has cured at least 14 days, correct high areas by grinding.
  4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
    - a. Finish repaired areas to blend into adjacent concrete.
  5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
    - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    - b. Feather edges to match adjacent floor elevations.
  6. Correct other low areas scheduled to remain exposed with repair topping.
    - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
    - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    - d. Place, compact, and finish to blend with adjacent finished concrete.
    - e. Cure in same manner as adjacent concrete.
  8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
    - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    - b. Dampen cleaned concrete surfaces and apply bonding agent.
    - c. Place patching mortar before bonding agent has dried.
    - d. Compact patching mortar and finish to match adjacent concrete.
    - e. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### **3.14 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
  1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
  3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

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- a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
  - 1) Project name.
  - 2) Name of testing agency.
  - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
  - 4) Name of concrete manufacturer.
  - 5) Date and time of inspection, sampling, and field testing.
  - 6) Date and time of concrete placement.
  - 7) Location in Work of concrete represented by samples.
  - 8) Date and time sample was obtained.
  - 9) Truck and batch ticket numbers.
  - 10) Design compressive strength at 28 days.
  - 11) Concrete mixture designation, proportions, and materials.
  - 12) Field test results.
  - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
  - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
  1. Headed bolts and studs.
  2. Verification of use of required design mixture.
  3. Concrete placement, including conveying and depositing.
  4. Curing procedures and maintenance of curing temperature.
  5. Verification of concrete strength before removal of shores and forms from beams and slabs.
  6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C143/C143M:
    - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests when concrete consistency appears to change.
  3. Slump Flow: ASTM C1611/C1611M:
    - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests when concrete consistency appears to change.
  4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
    - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:
    - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
  6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
    - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  7. Compression Test Specimens: ASTM C31/C31M:
    - a. Cast and laboratory cure two sets of two 6-inch by 12-inch or three 4-inch by 8-inch cylinder specimens for each composite sample.
    - b. Cast, initial cure, and field cure two sets of two 6-inch by 12-inch or three 4-inch by 8-inch cylinder specimens for each composite sample.
  8. Compressive-Strength Tests: ASTM C39/C39M.
    - a. Test one set of two 6-inch by 12-inch or three 4-inch by 8-inch cylinder laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    - b. Test one set of two 6-inch by 12-inch or three 4-inch by 8-inch cylinder field-cured specimens at seven days and one set of two specimens at 28 days.
    - c. A compressive-strength test shall be the average compressive strength from a set of two 6-inch by 12-inch or three 4-inch by 8-inch cylinder specimens obtained from same composite sample and tested at age indicated.
  9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
  11. Nondestructive Testing: Sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  12. Additional Tests:
    - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
      - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.
  13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Architect.

### **3.15 PROTECTION**

- A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
  2. Diaper hydraulic equipment used over concrete surfaces.
  3. Prohibit vehicles from interior concrete slabs.
  4. Prohibit use of pipe-cutting machinery over concrete surfaces.



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5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

**END OF SECTION 033000**

SECTION 03 35 43

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Installation of polished concrete floor system for new and/or existing interior concrete floors by dry grinding, application of concrete densifier, and polishing with various size grit metal-bonded and resin-bonded diamonds to the scheduled specified minimum local and overall gloss values.
2. Application of chemical dye.

B. Related Sections:

1. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 07 92 00 - Joint Sealants.
4. Section 09 65 00 - Resilient Flooring; Rubber base.

1.2 REFERENCES

- A. ASTM C 1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
- B. ASTM D 523 - Standard Test Method for Specular Gloss.
- C. NFSI - National Floor Safety Institute; Test Method 101A; current edition.

1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:

1. For each type of chemical product indicated, submit current specifications and product literature, as printed by the manufacturer of the products specified herein.
2. Submit information on all grinding equipment to be used.
  - a. Planetary grinder polishing equipment
  - b. Planetary grinder HEPA dust collection equipment
  - c. Hand tools
  - d. Hand tool dust collection equipment
  - e. Diamond tooling
  - f. High speed propane burnisher
  - g. Polyurea pump
  - h. Joint cutting saw
3. Manufacturer's chemical and product data sheets for:
  - a. Specified dye
  - b. Liquid reactive surface densifier
  - c. Liquid stain guard treatment
  - d. Joint filler
  - e. Crack and spall repair product
  - f. Self-leveling, dye-able, polishable overlay product
  - g. Grout coat, pin hole and small defect surface treatment
4. All proposed materials and methods of application are subject to review by the Architect and Owner.

- C. Samples: Submit manufacturer's full color palette for concrete coloring materials.

D. Installer's Certification:

1. Provide list of 5 projects performed with last three years of similar type, size and complexity. Submit project names, addresses, contacts and phone numbers for each project. General Contractor is to validate references and polisher's capabilities prior to submitting bid.

2. Applicator Qualifications: Submit letter of certification from each of the following manufacturers of products and equipment specified herein, stating that the applicator is a certified applicator of the system and is familiar with proper procedures and installation methods as required by the manufacturer.
  - a. Planetary grinder system
  - b. Liquid reactive surface densifier and stain guard treatment
  - c. Joint filler, crack and spall repair products

#### 1.4 QUALITY ASSURANCE

##### A. Regulatory Requirements:

1. Accessibility Requirements: Comply with applicable requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAGs) for Buildings and Facilities; Final Guidelines, revisions, and updates for static coefficient of friction for walkway surfaces.
2. Environmental Requirements: Comply with current Federal and local toxicity and air quality regulations and with Federal requirements on content of lead, mercury, and other heavy metals. Do not use solvents in floor polish products that contribute to air pollution or impact food quality.

##### B. Qualifications:

1. Installer trained and holding current certification for installation of specified products and polishing system.
2. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project. Contractor shall have completed 5 jobs of similar size, scope and complexity within the last 2 years.
3. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

##### C. Mock-Up: Prior to installation of dyed concrete finish system.

1. Accepted mock-up shall remain as part of finished product.
2. Mock-Up size will be 100 sq. ft. at project site at location as directed by Architect. Mock-up will be under conditions similar to those which will exist during actual placement.
3. Mock-up will include properly repaired surface spalls, slab joints and slab edge treatments including complementary edge banding.
4. Mock-up will be used to judge concrete substrate preparation, workmanship, operation of equipment, material application, color selection and shine.
5. Allow a minimum of 24 hours for inspection of mock-up. Mock-up shall be accepted before proceeding with work and before any color or pattern work is started.

##### D. Pre-installation Meetings: Schedule and convene a pre-installation meeting at the project site before start of installation of polished concrete floor system

1. Meeting to occur only after review and approval of required Sub-contractor submittals and completion of test panel mock-up, including specified grinding, polishing and dye, joint filling, spall and crack repairs, and specified overall gloss values.
2. Required attendance of parties directly affecting work of this section, including:
  - a. Project Architect
  - b. Polishing Consultant, if retained on project.
  - c. General Contractor
  - d. Polishing Subcontractor including Project Manager and Foreman
3. Pre-installation meeting agenda to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Review the following:
  - a. Existing conditions.
  - b. Environmental requirements.
  - c. Scheduling and phasing of work.
  - d. Coordinating with other work and personnel.
  - e. Protection of adjacent surfaces.
  - f. Surface preparation.
  - g. Repair of defects and defective work prior to installation.
  - h. Cleaning.
  - i. Installation of polished floor finishes.
  - j. Application of liquid hardener, densifier.
  - k. Protection of finished surfaces after installation.

#### 1.5 PROJECT CONDITIONS

- A. Sequence application of concrete polishing after completion of other construction activities that would be damaging to the completed polished concrete finish.

- B. Close areas to traffic during and after floor application for time period recommended in writing by manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact.
- B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- C. Waste Management and Disposal: Remove from site and dispose of packaging materials at appropriate recycling facilities.

## 1.7 WARRANTY

- A. Project Warranty: Refer to Contract Conditions for project warranty provisions.
- B. Manufacturer's Warranty: Submit 10-year warranty signed by polished concrete contractor for failure and replacement of materials and workmanship executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.
- C. Warranty commences on date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS

- A. Provide Polished Concrete Finishing Products by Ameripolish Concrete Polishing System™ (phone: 800.725.0033) or approved equal.
  - 1. Machinery Requirements: HTC Systems Unit 800 or SASE Diamatic System Unit 780 or equivalent size and head pressure machinery made for grinding concrete.
  - 2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
  - 3. Low Viscosity Crack and Spall Repair: Rapid Refloor in complementary matching color, by Metzger McGuire or approved equivalent.
  - 4. Wide Area Surface Repairs: Diama-Top by Ardex Engineered Cements or approved equivalent.
  - 5. Pin Hole and Surface Pitting Grout Coat: Diama-Fill, by Ardex Engineered Cements or approved equivalent.
  - 6. Concrete Hardener, Densifier: Water based, odorless liquid, VOC compliant, chemical hardening solution leaving no surface film.
  - 7. Concrete Colorant: Fast-drying dye, packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces.
    - a. Color: As scheduled in Color Schedule.
    - b. Finish: Standard High gloss (HG-1), 1500 grit.
    - c. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
  - 8. Cleaning Solution: Mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
- B. Design Requirements: Coordinate requirements for concrete to be polished with requirements for concrete stipulated by Section 03 30 00 -Cast-in-Place Concrete.
  - 1. Hardened Concrete Properties:
    - a. Minimum Concrete Compressive Strength: 3500 psi.
    - b. Normal Weight Concrete: No lightweight aggregate.
    - c. Non-air entrained.
  - 2. Placement Properties:
    - a. Natural concrete slump of 4-1/2 inches - 5 inches. Admixtures may be used.
    - b. Flatness Requirements:
      - 1) Overall FF 40.
      - 2) Local FF 20.
  - 3. Hard-Steel Troweled (3 passes) Concrete:
    - a. No burn marks. Finish to ACI 302.1R, Class 5 floor.
  - 4. Curing Options:
    - a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure).
      - 1) Acrylic curing and sealing compounds not recommended.

- b. Sheet membrane (ASTM C171); polyethylene film not recommended.
- c. Damp Curing: Seven day cure.

## 2.2 SYSTEM DESCRIPTION AND PERFORMANCE

- A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:
  - 1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch wear in 30 minutes.
  - 2. Reflectivity: Increase of 35% as determined by standard gloss meter.
  - 3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
  - 4. High Traction Rating: NFSI 101-A, non-slip properties.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site Verification of Conditions: Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.
- B. Specifier Note: Consult floor finishing product manufacturer for additional concrete placement specifications required for application of floor finishing products. Coordinate with Section [03 30 00 Cast-in-Place Concrete]. Verify Concrete Slab Performance Requirements:
  - 1. Verify concrete is cured to 28 day, at strength as specified in Section 03 30 00 - Cast-In-Place Concrete.
  - 2. Floor and Joints: Dry and free of debris and excessive dirt, dust, clay, and mud.
  - 3. Floor Finish: Wide channel floated, smooth, pan, combination blade and plastic blade finished floor from edge to edge, with no rough areas. Verify concrete surfaces received a hard steel-trowel finish (3 passes) during placement.
  - 4. Concrete Adjacent to Floor Penetrations: Troweled flat and level with surrounding concrete.
- C. Notify the General Contractor in writing of conditions that would adversely affect installation or subsequent use prior to commencement of polishing.
- D. Do not begin surface preparation or installation until conditions are corrected and approved.

### 3.2 PREPARATION

- A. Examine surface to determine soundness of concrete for polishing.
- B. Remove surface contamination, fins and projections.
- C. Chalk lines laid out for any purpose are acceptable as long as they are not sprayed down with clear acrylic.
- D. Protection: Protect surrounding areas and adjacent surfaces from the following:
  - 1. Minimal accumulation of dust from grinding and polishing.
  - 2. Contact with overspray of penetrating hardener / densifier.
  - 3. Contact with overspray of protective surface treatment (stain guard)
  - 4. Contact with overspray of water or solvent based dye treatment.
  - 5. Contact with joint filler, crack or spall repair materials
- E. On existing concrete floors, completely remove existing flooring, mastics, adhesives, self-leveling underlayment fillers and other foreign matter.
- F. On existing concrete floors, remove the top ½ of an inch of existing joint material and replace with approved joint filler and crack repair products.
- G. Clean Surfaces: Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants which could adversely affect installation of polished concrete floor system.

### 3.3 INSTALLATION

- A. Install polished concrete floor system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Aggregate Exposure:
  - 1. Fine Aggregate: Mottled salt-and-pepper aggregate exposure.

C. Polished Concrete Floor System

1. Open Slab Surface:

- a. As required to provide a uniform final polish or removal of existing floor coatings, begin grinding with 40 or 80-grit metal bond. Bids shall be based on starting initial cut with 40-grit metal diamonds. Expose coarse concrete aggregate when required to reach lows spots within floor surface.
- b. Review condition of floor. Obtain written approval if large coarse aggregate is required to be exposed to remove existing coatings, floor underlayment or slab deficiencies. Variations to the precise grinding, densifying, polishing, dying and stain guard application are anticipated, but must be discussed and approved in writing prior to executing the work.
- c. For new concrete floors, open-up concrete by grinding with 80-grit metal-bonded.
- d. Progressive edge grinding will be necessary with 1/2" of all vertical abutments, including walls, cases, columns, posts and racking systems.
- e. Joint filler and spall repairs shall be flush with surface after grinding and polishing steps. Additional passes along curled joints may be necessary to remove joint filler chatter.

2. Remove metal-bonded diamond scratches by grinding with progressively finer metal-bonded diamonds, up to metal bond 150-grit.

3. Apply densifier

- a. Per manufacturer's recommendations and the concrete's acceptance of the product.

4. Floor Polishing:

- a. Remove 150-grit metal-bonded diamond scratches by grinding with a transitional diamond per manufacturers recommendation
- b. Remove transitional resin-bonded diamond scratches by grinding with 100-grit resin-bonded diamonds.
- c. Remove 100-grit resin-bonded diamond scratches by grinding with 200-grit resin-bonded diamonds.
- d. Remove 200-grit resin-bonded diamond scratches by grinding with 400-grit resin-bonded diamonds.
- e. Remove 400-grit resin-bonded diamond scratches by grinding with 800-grit resin-bonded diamonds.
- f. Remove 800-grit resin-bonded diamond scratches by grinding with 1500-grit resin-bonded diamonds.

5. Apply stain guard

- a. Apply in accordance with manufacturer's published instructions.
- b. Apply first coat per manufacturer's recommendation (DO NOT OVER APPLY).
- c. Use applicator pad, pre-wetted with stain guard, to pull material out to create a thin film prior to drying.
- d. Remove product completely from areas of over application, as evidenced by surface streaking, and replace with unused stain guard.
- e. Apply second coat of stain guard at all high traffic areas identified on the drawings per manufacturer's instructions.

6. High speed burnish:

- a. After each application of stain guard is dry, burnish surface.
- b. Burnish using approved pads, at a slow movement pace using high speed machine with 400 or 800 grit diamond impregnated pads as required to achieve specified gloss requirements.
- c. Burnish with several passes. Make each progressive pass at 90 degrees from previous pass.
- d. Burnishing, pad type, and pace of forward movement shall combine to develop a minimum floor surface temperature of 91-degrees F directly below the burnishing pad as continuously measured by the operator during installation.

D. Penetrating Dye

1. Mix dye in accordance with installer's instructions.
2. Where shown on Architectural drawings, saw-cut reveal line around room periphery. Use Mongoose concrete saw or similar to cut precise intercepts. Use tape and protection along saw cut to prevent main floor dye from penetrating concrete surface to receive edge band.
3. Apply 2-coats of AmeriPolish or approved equivalent solvent based dye color per plans.
4. Apply penetrating dye after 200 or 400-grit resin-bonded diamond-grinding step in accordance with manufacturer's recommendations and approved mock-up.
5. Thoroughly auto-scrub surface clean of excess dye residue in accordance with manufacturer's instructions.
6. Repeat application of penetrating dye if due to porosity of floor or darker color is desired as selected by Architect. Bids shall be based on providing 2 applications of Dye.

3.4 FIELD QUALITY CONTROL

- A. Inspect completed polished concrete floor system with the Architect, Concrete Consultant, General Contractor, and Polished Concrete Installer.
- B. Review procedures with owners Consultant to correct unacceptable areas of completed polished concrete floor system.

C. Specular Gloss/Reflectance, ASTM D 523:

1. Perform polishing and burnishing work necessary to produce a Specified Overall Gloss Value (SOGV)  $\geq 50$  prior to applying protective surface treatment, SOGV  $\geq 60$  after applying protective surface treatment, Minimum Local Gloss Value (MLGV)  $\geq 40$  after applying protective surface treatment as measured using a Horiba IG-320 60 Degree Gloss Checker.
2. Gloss shall be considered as a quantitative value that expresses the degree of reflection when light hits the concrete floor surface. Gloss measurements will be taken independent of ambient lighting and will be taken within a sealed measurement window located beneath the test unit.
3. Collects 12 readings minimum, throw out low and high measurements and average remaining measurements. Average shall exceed SOGV. No single measurement shall be less than MLGV.

3.5 ADJUSTMENTS

- A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.
- B. Fill joints flush to surface.

3.6 FINAL CLEANING

- A. Final clean in accordance with Section 01 74 13 - Progress Cleaning.
- B. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.
- C. Clean adjacent materials and surfaces and work area of foreign materials resulting from work of this section.
- D. Upon completion, contractor must remove surplus and excess materials, rubbish, tools and equipment.

3.7 PROTECTION

- A. Protect completed polished concrete floor system from damage until Substantial Completion.
  1. Do not allow vehicle and pedestrian traffic on unprotected floor.
  2. Do not allow construction materials, equipment, and tools on unprotected floor.
  3. Prohibit parking of vehicles on concrete slab.
  4. Protect from petroleum stains during construction.
  5. If construction equipment must be used for application, diaper components that might drip oil, hydraulic fluid, or other liquids. This is especially important with hydraulic lifts.
  6. No tire embedments (rocks, nails, screws, etc.) that will scratch or pit slab surface.
  7. Check lift tires daily for screws.
  8. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
  9. Prohibit temporary placement and storage of steel members or reinforcing steel on concrete slab.
  10. Prohibit acids and acidic detergents from contacting concrete surfaces.
  11. Cover concrete floors with drop cloths or use breathable drop cloths during painting. If paint is spilled on concrete floor, remove paint immediately.
  12. Protect slab surface from standing moisture for 72 hours to prevent re-emulsification of surface treatment prior to cure
- B. Protect adjacent materials from damage during installation of polished concrete.
- C. Chalk lines laid out for any purpose are acceptable as long as they are not sprayed down with clear acrylic.
- D. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed polished concrete floor system.
- E. Repair damaged areas of completed polished concrete floor system to satisfaction of the Architect and owners Consultant.
- F. Protect completed areas with EZ Cover™ by McTech Corp. (phone: 866.913.8363 website: <http://www.mctechgroup.com/ezcover.html>), or comparable product.

END OF SECTION

SECTION 03 35 46

CONCRETE TOPICAL TREATMENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Work Included:
  - 1. Application of cure and seal to new, patched, and existing concrete floor slabs.
  - 2. Application of densifier/hardener to new and existing concrete floor slabs.

- B. Related Work:
  - 1. Section 03 30 00 - Cast-In-Place Concrete

1.2 SUBMITTALS:

- A. Product Data: Manufacturer's complete product information and application instructions.
- B. Certificate: Manufacturer's written certification that proposed products comply with applicable Volatile Organic Compound (VOC) regulations.

1.3 QUALITY ASSURANCE:

- A. Comply with Texas Natural Resources Conservation Commission *Regulation V* regarding VOC content of Architectural coatings. Architectural coatings are protective or decorative coatings applied to interior or exterior of buildings or structures, including latex paint, alkyd paints, stains, lacquers, varnishes, and urethanes.
- B. Apply only when air temperature is between 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. Cure and Seal Basis of Design: Provide VOCOMP-25 cure and seal for concrete surfaces that produces a clear, high gloss, non-yellowing, slip-resistant penetrating finish as manufactured by W. R. Meadows.
  - 1. Acceptable Manufacturers:
    - Super Diamond Clear VOX; Euclid Chemical
    - L&M Dress & Seal WB25; L&M Construction Chemicals/Laticrete International
    - Vocomp 25; W.R. Meadows
  - 2. Substitutions for Equivalent Products: Refer to SECTION 01 62 00 - PRODUCT OPTIONS for substitution request procedures.
  - 3. Water-based acrylic curing and sealing compound shall be a non-yellowing, clear, acrylic curing and sealing compound meeting the following requirements:
    - a. ASTM C 309, Type 1, Class B
    - b. AASHTO M 148, Type 1, Class B
    - c. ASTM C 1315, Class A, Section 6.4.1 – non-yellowing
    - d. ASTM C 1315, Section 6.6 – exceed 50 MPa (70 psi) adhesion requirements.



- B. **Densifier/Hardener Basis of Design:** Provide Seal Hard as manufactured by Laticrete International, a densifier and dustproofers 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. CECS 03300 4-79
    - b. ACI 302, Class 1 through 4 Concrete Floors

### PART 3 - EXECUTION

#### 3.1 PREPARATION:

- A. Prepare concrete surfaces to be sealed and hardened according to manufacturer's recommendations.
  - 1. Remove all existing curing compounds, oil, grease, laitance, and other incompatible materials.
  - 2. Apply cure and seal / 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. At new concrete, apply after surface water glaze is gone.
- B. Spray first coat uniformly at the rate of 300 sf/gal. Let first coat dry 6 to 8 hours before applying second coat. Apply second coat uniformly at the same rate in the opposite direction. Squeegee or wipe up all puddling.
- C. Apply only to areas where sealed or hardened concrete floor finish is scheduled.
- D. Apply two uniform coats at 300 sf per gallon each without puddling, according to manufacturer's written instructions.

#### 3.3 CLEANING AND PROTECTION:

- A. Clean up and legally dispose of all debris, containers, and other materials from flooring work. Remove from Owner's property.
- B. Protect surfaces from traffic for at least 8 hours after final coat application.

END OF SECTION

SECTION 03 52 16

INSULATING CONCRETE DECKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cast-in-place lightweight insulating concrete, placed over structural subbase installed by others.
- B. Related Sections:
  - 1. Section 05 31 00 - Steel Decking: Requirements for ventilated decking.
  - 2. Section 06 10 00 - Rough Carpentry: Wood blocking, curbs

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples.
- B. Product data
  - 1. Describe products and methods of mixing and application instructions.
  - 2. Include plans, sections, and details showing roof slopes, lightweight concrete roof insulation thicknesses, embedded board insulation, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.
- C. Certificates by an independent testing laboratory stating that materials and mix intended to be used meet specified requirements.

1.3 QUALITY ASSURANCE

- A. Insulating Concrete Supplier: Regularly engaged in production of lightweight insulating concrete materials.
- B. Insulating Concrete Applicator: Regularly engaged and properly equipped for application of lightweight insulating concrete, and as acceptable by aggregate producer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- B. Store packaged materials to protect them from elements or physical damage.
- C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.5 JOB CONDITIONS

- A. Do not place lightweight insulating concrete when ambient temperature is at or below freezing (32°F).
- B. When air temperature has fallen or is expected to fall below 40°F., heat water to a maximum 120°F. before mixing to attain lightweight concrete at point of placement with temperature of 50°F. min. and 80°F. max.
- C. Do not place lightweight insulating concrete on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vermiculite-Type Insulating Concrete Materials
  - 1. Portland Cement: ASTM C 150, Type I or Type III.
  - 2. Mineral Aggregate: ASTM C 332, Group I, vermiculite.
  - 3. Sand Aggregate: ASTM C 33.

4. Water: Clean, potable.
  5. Air-Entraining Admixture: ASTM C 260.
- B. Cellular-Type Insulating Concrete Materials.
1. Portland Cement: ASTM C 150, Type I or Type III.
  2. Foam Concentrate: Protein-based foam concentrate conforming to ASTM C869 and ASTM C796.
  3. Curing Compound: Type recommended by manufacturer.
- C. Perlite-Type Insulating Concrete Materials
1. Portland Cement: ASTM C 150, Type I or Type III.
  2. Mineral Aggregate: ASTM C 332, Group I, perlite.
  3. Sand Aggregate: ASTM C 33.
  4. Water: Clean, potable.
  5. Air-Entraining Admixture: ASTM C 260.
- D. Control Joint Filler: ASTM C 612, Class 2, glass fiber type, Compressing to one-half thickness under a load of 25 psi.
- E. Insulation Board: Rigid polystyrene boards or formed units with minimum density of 1 pcf complying with ASTM C 578.
1. Keying Holes: Provide units with keying holes of approximately 3 percent of board gross surface area.
  2. Thickness: Provide units in thickness to reach R-Value per Building Envelope Roof Assembly Type on drawings.

## 2.2 DESIGN MIX

- A. General: Design lightweight insulating concrete mix to produce the following minimum physical properties.
1. With Vermiculite Aggregate:
    - a. Wet Density at Point of Placement: 44 to 60 pcf, when tested in accordance with ASTM C 138.
    - b. Oven-Dry Density: 22 to 28 pcf, when tested in accordance with ASTM C 495.
    - c. Compressive Strength: Minimum 125 psi, when tested in accordance with ASTM C 495.
  2. With Cellular Mix:
    - a. Wet Density: 53 to 63 lb./cu. ft. when tested according to ASTM C138.
    - b. Oven-Dry Density: 31 to 37 lb/cu.ft., when tested according to ASTM C 495.
    - c. Compressive Strength: Minimum 200 psi when tested according to ASTM C 495.
  3. With Perlite Aggregate:
    - a. Wet Density at Point of Placement: 38 to 40 pcf, when tested in accordance with ASTM C 138.
    - b. Oven-Dry Density: 24 to 30 pcf, when tested in accordance with ASTM C 495.
    - c. Compressive Strength: Minimum 140 psi, when tested in accordance with ASTM C 495.
- B. Do not exceed maximum air content recommended by aggregate manufacturer.
- C. Use minimum amount of water necessary to produce a workable mix.
- D. Do not use Calcium dioxide in lightweight insulating concrete fill.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of insulation control joints.
1. Provide 1-inch-wide expansion joint material for roof areas with dimensions up to 100 ft. in length; 1-1/2 inches thick for roof area dimensions exceeding 100 ft.
- B. Reinforcing Mesh: Place reinforcing mesh at right angles to structural supports; end laps at least 6 inches and no side laps. Cut to fit around roof openings and projections. Terminate mesh at control joints.

### 3.2 PLACEMENT

- A. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.

- B. Install insulation board according to lightweight insulating concrete manufacturer's written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards.
- C. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated on drawings. Leave top surface in acceptable condition to receive subsequent roofing application.
- D. Begin curing operations immediately after placement, and air cure for not less than 3 days in accordance with manufacturer's recommendations.
- E. Provide temporary protection of removable waterproof covering to prevent direct exposure to moisture if roofing application is not started immediately after completion of curing.

### 3.3 FIELD QUALITY CONTROL

- A. Engage an independent testing laboratory acceptable to Architect to take samples and conduct tests to evaluate lightweight insulating concrete. Do not use same testing service that provided initial mix designs.
- B. Owner will engage an independent testing laboratory to take samples and conduct tests to evaluate lightweight insulating concrete.
  - 1. Take samples in accordance with ASTM C 172, except as modified by ASTM C 495.
  - 2. Determine wet density in accordance with ASTM C 138.
  - 3. Determine compressive strength and oven-dry density in accordance with ASTM C 495. Make at least 6 molds during each placement.
- C. Report test results to Architect and lightweight insulating concrete producer within 24 hours of completion of each test.

### 3.4 DEFECTIVE WORK

- A. General: Refinish or remove and replace lightweight insulating concrete surfaces that are too rough to receive finish roofing, or where physical properties do not meet specified requirements, as determined by Architect.

END OF SECTION

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SECTION 04 20 00

MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Unit masonry construction.
- B. Related Requirements:
  - 1. Section 01 45 23 - Testing and Inspection Services.
  - 2. Section 05 50 00 - Metal Fabrications: steel lintels.
  - 3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
  - 4. Section 07 65 00 - Flexible Flashing: through-wall flashing for masonry walls.
  - 5. Section 07 19 00 - Water Repellents.
  - 6. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.
  - 7. Section 07 92 00 - Joint Sealants.
  - 8. Section 07 95 00 - Expansion Control.
  - 9. Section 08 11 00 - Hollow Metal Doors and Frames: installation of steel frames.
  - 10. Section 10 99 00 - Miscellaneous Specialties; Recessed Knox Box.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit for each type of product indicated.
  - 1. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
- C. Samples: Within 60 days after the contract has been awarded, submit manufacturer's standard sample panel showing full range of color, approximately 12" x 24" for each color and size of brick required.
- D. Test Reports: Manufacturer of the concrete masonry units shall submit:
  - 1. Certified test reports showing that the units to be furnished meet the requirements of ASTM C 90 and C 129, and have the required minimum compressive strengths.
  - 2. Reports certifying concrete masonry units meet or exceed each of the fire-resistive ratings.
- E. Provide a diagram of proposed control joints and expansion joints.
- F. Submit steel reinforcing shop drawings for load-bearing concrete masonry unit walls, including elevations showing reinforcing, control joints, bond beams, dimensions and details.
- G. Mortar Mixture Proportions: ASTM C 270, Submit copies of each proposed mix design for review prior to starting masonry work.
- H. Grout Mixture Proportions: ASTM C 476, Submit copies of each proposed mix design for review prior to grout placement.
  - 1. Include recent historical grout cylinder strength test reports for each mix design.
- I. Pre-blended Mortar and Grout Certificates: Submit manufacturer's certificates that products meet or exceed specified requirements.
  - 1. Mortar: Submit test reports, per ASTM C 780, for each mortar mix indicating strength of mortar mixes. Submit computer batch-ticket to confirm the mixes meet the project SPEC MIX specifications for every bag of mortar.
  - 2. Grout: Submit test reports, per ASTM C1019, for each grout mix indicating compressive strengths. Submit computer batch-ticket to confirm the grout mixes meet the project SPEC MIX specifications for every bag of grout.

### 1.3 QUALITY ASSURANCE

- A. Manufacturer: Manufacturer shall have a minimum of five years' experience manufacturing the specified product.
- B. Installer: Masonry contractor shall have a minimum of five years' experience in similar types of work and be able to furnish a list of previous jobs and references if requested by the Architect.
- C. Pre-installation Conference: Contractor shall schedule pre-installation conference at the project site with Architect/Engineer and Owner's Testing Lab. Conference shall be held prior to proceeding with masonry work and shall comply with requirements in Division 01 Section "Project Management and Coordination".
- D. Expansion Joints (Control Joints): Provide expansion joints as shown on the Drawings or if not shown, install at frequency and in accordance with details as recommended by the N.C.M.A. or B.I.A. Confirm locations and frequency with Architect before beginning work. Refer to expansion joint Paragraph in the Installation portion of this specification section.
- E. Mock-up: Construct sample wall panels at the site using brick veneer, CMU, mortar, and masonry backup proposed for the project. The panel shall duplicate the typical building wall construction (coursing, bonding, joint treatment, sealant, cleaning methods and materials as required in SECTION 07 92 00 - JOINT SEALANTS). Sample panel shall be fully acceptable to the Architect prior to ordering of materials. Install one vertical 3/8" control joint for full height of panel. Panel shall be not less than 4 ft. by 3 ft. Construct panel on a wood pallet, providing portability around the project site. Do not alter nor destroy mock-up until attainment of Substantial Completion. Approved mock-up panel shall be the standard of comparison for workmanship and materials.
- F. Fire-resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Brick Delivery: Do not lay face brick until at least 50% of the brick for the project has been delivered. As brick work progresses, make additional deliveries of brick so that at all times at least 50% of the remaining brick requirements are on the project site. Serve masons brick intermixed from the various storage piles to assure blending of brick.
- B. Store face brick and masonry units above ground on wood pallets which allow air circulation under the stacked units.

### 1.5 PROJECT CONDITIONS

- A. Refer to "Protection" Paragraph for daily activities.
- B. Cold Weather Construction: Do no masonry work when freezing weather is expected. If Contractor elects to lay masonry when air temperature falls or is expected to fall below 40°F., provide construction means and protection of completed masonry as described in BIA Technical Note 1 - Cold and Hot Weather Construction -- Construction and Protection Recommendations.
  - 1. The use of admixtures or antifreezes to lower the freezing point of mortar shall not be permitted.
- C. In hot weather (above 99°F. with less than 50% relative humidity) protect masonry construction from direct exposure to sun and wind.
- D. Temporary Bracing: Take adequate precautions to prevent damage to walls during erection by high winds or other forces. Where necessary, provide temporary bracing until the designed lateral strength is reached.

## PART 2 - PRODUCTS

### 2.1 MASONRY MATERIALS

- A. Brick Veneer: ASTM C 216 face brick or ASTM C 652 hollow brick.
  - 1. Face Brick: ASTM C 216, Grade SW, Type FBS, face brick.

2. Brick Veneer MA-01, MA-02, MA-03": King size face brick or hollow brick with actual dimensions of 2-3/4"D x 2-5/8"H x 9-5/8"L as manufactured by Acme Brick and as scheduled; reference Drawings. Manufacturer's identification on brick will not be acceptable.
  3. Substitutions: Requests for substitutions will be considered in accordance with provisions of SECTION 01 62 00 - PRODUCT OPTIONS.
- B. Special Brick Shapes: Provide special shapes and sizes of face brick and glazed brick as required for a complete project. Exposed surfaces to match the face brick in color, texture, and blend. Special shapes and sizes shall include, but not be limited to, the following:
1. Solid bricks at soldier bond corners
  2. Two-faced brick at corners, windows, and doors.
  3. Solid bricks at windowsills.
  4. Corner bricks at radiused walls.
  5. Radiused brick at columns.
- C. Common Brick: ASTM C 62, Grade MW, hard-burned stiff mud or dry-pressed brick. Use common brick where concealed brick is required.
- D. Sound Absorbing Concrete Masonry Units (6C): Hollow units with solid closed top, fabricated from Portland cement and lightweight mineral aggregate, "Soundblox" Types 12" RSC/RF (8" RF and 4" RSC) as manufactured by the Proudfoot Company, Inc., Monroe, CT (phone 203.459.0031 web site: [www.soundblox.com](http://www.soundblox.com)), providing a minimum NRC of 0.80.
1. All units shall be from the same manufacturing plant, shall have the same surface texture and shall meet the requirements of ASTM C 90, Grade N-I, moisture controlled, for load-bearing units.
  2. Nominal Size: 8" x 16" face.
  3. Sound Absorption: Two cavities with two funnel-shaped slots in each block. Each cavity shall have incombustible fibrous fillers with metal septa factory installed.
  4. Provide left and right sound block units as required for reinforced masonry construction where shown on drawings.
  5. Minimum compressive strength as shown on the structural drawings.
  6. Provide "equivalent concrete masonry thickness" required for fire-rated assemblies where required.
- E. Concrete Masonry Units: ASTM C 90, Grade N-I, moisture controlled, for load-bearing units; ASTM C 129, moisture controlled, Type I, for non-load-bearing units. Provide hollow units made from Portland cement and lightweight mineral aggregate.
1. All units shall be from the same manufacturing plant and shall have the same surface texture.
  2. Use load-bearing units for exterior wall backup and load-bearing partitions, non-load-bearing units elsewhere.
  3. Provide 1" bullnose units at exposed outside corners and jambs and as noted on drawings.
    - a. Provide square edge starter course corners at all rubber base conditions where preformed base corners are specified to be provided.
    - b. Provide square edges at all furred units and units to be covered with ceramic tile.
  4. Provide sash block control joints at concrete block walls with pre-molded rubber control joint filler.
  5. [modular brick] Provide 5" starter blocks where required. --- OR --- [king size brick = 4" starter blocks]
  6. Nominal Size: 8" x 16" face.
  7. Minimum compressive strength as shown on the structural drawings.
  8. Provide "equivalent concrete masonry thickness" required for fire-rated assemblies where required.
- F. Related Materials:
1. Bond Breaker: ASTM D 226, Type I (No. 15), non-perforated asphalt-saturated felt.

## 2.2 REINFORCING AND TIES

### A. Wall Ties: ASTM A153

1. For Brick Veneer at CFS: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, stainless steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in Section 07 2100 - Building Insulation. Also provide polymer-coated screws and stainless steel ties/pintles of 3/16" diameter, with pintle length as required.. Product/manufacturer; one of the following:
  - 213 with 282; Heckman Building Products, Inc.
  - HB-213 with 2X Hook; Hohmann & Barnard, Inc.
  - 2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)



2. For Brick Veneer at CMU: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, stainless steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated Tapcon screws and stainless steel ties/pintles of 3/16" diameter, with pintle length as required.. Product/manufacture; one of the following:  
213 with 282; Heckman Building Products, Inc.  
HB-213 with 2X Hook; Hohmann & Barnard, Inc.  
2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)
  3. For solid masonry, ties shall be 16 gage hot dip galvanized corrugated steel straps 7/8" wide x 7" long.
  4. For glazed facing tile, ties shall be 10 gage hot dip galvanized steel wire loops or 18 gage galvanized corrugated steel straps.
- B. Triangular Ties and Column Anchors: ASTM A 82 hot dip galvanized steel wire, 3/16" diameter ties and 1/4" diameter anchors, for tying masonry walls to steel columns.
- C. Dovetail Anchors: 16 gage hot dip galvanized corrugated steel ties 1" wide x 4 1/2" long.
- D. Joint Reinforcement at Single-wythe Concrete Masonry Unit: Provide ladder type with continuous 9 gage ladder side and cross rods spaced not more than 16" o.c. and welded, unless smaller spacing is shown on the drawings. Product/manufacture; one of the following:  
#220 Ladder-Mesh; Hohmann & Barnard, Inc.  
Series 200 Ladder Mesh; Wire-Bond
1. Finish shall be Class 1 mill galvanized.
  2. Corners and tees shall be prefabricated.
- E. Wall Ties for CMU Veneer at CMU Backup: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, stainless steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated screws and stainless steel ties/pintles of 3/16" diameter, with pintle length as required. Product/manufacture; one of the following:  
213 with 282; Heckman Building Products, Inc.  
HB-213 with 2X Hook; Hohmann & Barnard, Inc.  
2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)
- F. Joint Reinforcement at Multi-wythe Concrete Masonry Unit: Provide ladder type with continuous 9 gage side and cross rods spaced not more than 16" o.c. and welded, unless smaller spacing is shown on the drawings. Product/manufacture; one of the following:  
#270-2X Ladder Eye-Wire; Hohmann & Barnard, Inc.  
Series 800 Ladder; Wire-Bond
1. Finish shall be hot-dip galvanized.
  2. Corners and tees shall be prefabricated.
- G. Joint Reinforcement at Multi-wythe Concrete Masonry Units: Truss design with continuous 9 gage side rods and 9 gage diagonal cross rods spaced not more than 16" o.c., unless smaller spacing is shown on the drawings, #140 Truss-Twin-Mesh as manufactured by Hohmann & Barnard, Inc. or approved equivalent.
- H. 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:  
"Seismicclip Interlock System" #187; Hohmann & Barnard, Inc.
- I. 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](http://www.lambertsw.com)) or Solomon Colors (phone 800.624.0261 web site [www.solomoncolors.com](http://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 sandColoring 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 sandColoring 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
- B. Mixing:
  - 1. All dry material shall be accurately measured in a leak-proof batching box. Contractor shall have the option of using a pre-manufactured cubic foot batching box or fabricating a wood box for measuring dry materials by volume. Box may be a convenient size, but shall be not less than 12" x 12" x 12" inside dimensions. The use of shovels for measuring dry materials is strictly prohibited.
  - 2. Proportion mortar accurately and mix thoroughly with the maximum amount of water to produce a workable consistency for at least 5 minutes in a mechanical batch mixer. Keep tools and mixing equipment clean.
  - 3. Do not use mortar which has begun to set, or if more than 2½ hours have elapsed since initial mixing. Do not re-temper mortar.
  - 4. Mortar for Split-face, Smooth-face, and Burnished Concrete Masonry Units: Add water repellent admixture at manufacturer's recommended rates to ensure mortar will be permanently water repellent.
- C. Use: Lay exterior and interior masonry veneer construction using Type N mortar. Lay exterior masonry veneer below grade or in contact with earth using Type M mortar. Lay exterior and interior load-bearing masonry using Type S mortar. Where required use bedding mortar to set and fill hollow metal frames.
- D. Masonry cement is not acceptable for mortar.
- E. Do not use calcium chloride in mortar.
- F. Pre-mix, dry or wet, is not acceptable for mortar, except as listed below; i.e. no other pre-mix mortars are acceptable.

## 2.5 MORTAR; PRE-BLENDED MORTAR MIXES, COLORED MORTAR MIXES, AND INTEGRAL WATER REPELLENT MORTAR MIXES

- A. Contractor's Option: Provide pre-blended mortar mix, colored mortar mix, and integral water repellent mortar mix as manufactured by SPEC MIX, Inc. (phone 888.773.2649 web site: [www.specmix.com](http://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](http://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.

## 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](http://www.mortarnet.com)).
  - 1. 0.4" thick Mortar Net between back of brick and steel lintels, cut down to required height.
  - 2. Provide single thickness 2" material at 1-3/4" to 2-1/4" wide masonry cavities.
- 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](http://www.cavclear.com)).
- E. Provide "BlockFlash" as manufactured by Mortar Net USA, Ltd. CMU cell flashing pans with built-in adjoining bridge made from recycled polypropylene with chemical stabilizers that prevent UV degradation. Flashing pans have a sloped design to direct moisture to the integrated weep spout. Designed to be built into mortar bed joints to expel moisture (unimpeded by mortar droppings) to the exterior of CMU walls.
- F. Rebar Positioners: Size and type required to accurately place reinforcing steel in bond beams, concrete masonry unit lintels, and vertically in walls.
- G. Joint Stabilization Anchors: Mill-galvanized. Product/manufacturer: Slip-set Stabilizer; Hohmann and Barnard

## 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:  $\pm 1/4$ .
  - 6. Maximum Variation in Mortar Joint Thickness:
    - a. Bed Joint:  $\pm 1/8$ ".
    - b. Head Joint:  $\pm 1/8$ ".
- B. Dimensions are based modular 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 uncured 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. Laying Concrete Masonry Units: Spread mortar beds smooth and full to cover bearing areas. Do not furrow. Butter head joints and shove units into place. Head joints shall be staggered except where stack bond is specifically indicated. Make back joints full against the backing materials as each course is laid.
1. Leave pipe spaces open on one full side until pipe work has been completed and inspected.
  2. Lay concrete masonry walls and partitions level, plumb, straight, and true to line within tolerances specified above.
  3. Fill the cells of exposed concrete masonry units with grout for a width of 8" at the jambs of openings in exterior walls.
  4. Exposed ends of units at external corners shall be solid.
  5. Units shown to be laid in stack bond shall be laid with such accuracy that a plumb line centered on a vertical joint in an upper course will be entirely within the width of the corresponding vertical joint in every lower course.
  6. Unless shown otherwise, provide vertical control joints every 40'.
  7. At sound absorbing concrete masonry units, provide slip-set stabilizer at 16" o.c., vertically,
  8. Maximum pour of grout in vertical cells shall be limited to 5'-0" unless cleanouts are provided at each cell.
- E. Installation of Reinforced Unit Masonry:
1. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
    - a. Construct formwork to conform to shape, line, and dimensions shown. make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
    - b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
  2. Set reinforcing in required position and secure against displacement before grouting is started. Cells requiring vertical reinforcement and grout shall be aligned to provide continuous unobstructed vertical opening. Place vertical reinforcing in cells with enough steel extending to provide proper lap splice. Horizontal steel shall be fully embedded in grout.
  3. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
    - a. do not exceed the following pour heights for fine grout.
      - 1) For minimum widths of the grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches, pour height of 12 inches.
      - 2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 60 inches.
      - 3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.
      - 4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 24 feet.
    - b. Do not exceed the following pour heights for coarse grout.
      - 1) For minimum widths of the grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
      - 2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
      - 3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.
      - 4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.
  4. Provide cleanout holes at least 3 inches in least dimension for grout pours over 60 inches in height. Cleanouts shall be sealed after inspections before grouting.
    - a. Provide cleanout holes at each vertical reinforcing bar.
  5. Place grout in lifts not exceeding 5 feet.
  6. Consolidate grout at the time of initial placement.
  7. Grouting of a section of wall shall be completed within one day with no interruptions greater than one hour.
- F. Reinforcing Masonry Joints: Reinforce the bed joints of concrete masonry unit walls and partitions with continuous joint reinforcement strips.
1. Furnish strips in long lengths. Width of strips shall be 2" less than nominal overall width of the wall or partition.
  2. Lap strip ends 12" and bed side rods in mortar for complete cover and bond.
  3. Install strips in bed joints spaced 16" o.c. for exterior walls and 24" o.c. for interior partitions, unless a smaller spacing is shown in the drawings. Reinforcement shall extend into and bond the facing wythe in walls.

4. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.
  5. At interior masonry walls and intersection of interior/exterior masonry walls, continue horizontal joint reinforcement across control joints.
- G. 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.
- H. Bonding: Tie together masonry unit construction within walls and at intersections of walls by masonry bond and staggered vertical joints. Toothing will not be permitted except where specifically authorized by the Architect. Where walls must be built in advance of adjacent walls, form the stop-off by racking back.
1. Lay brick facing wythe in standard running bond with staggered head joints except where special coursing is indicated. Tie multiple wythe construction together with horizontal joint reinforcement and tab ties.
  2. Where bond with joint reinforcement cannot be made, use wall ties spaced not more than 16" o.c. horizontally and vertically. Ties shall be laid in the joints, not shoved into wet mortar after setting the next course of masonry.
  3. Tie brick veneer back to steel stud curtain walls and concrete unit masonry with metal ties spaced 16" o.c. horizontally and 16" o.c. vertically. Around the perimeter of openings, edges, and tops and bottoms of walls, additional ties/anchors shall be installed at a maximum of 3 ft. o.c. within 12" of the opening. Secure ties through the sheathing to the studs with two screws and insert ties.
    - a. Secure wall tie backplates with fasteners that are wet-set with sealant compatible with the air- and water-resistive barrier system. **\*\*ADD THE FOLLOWING FOR HOUSTON PROJECTS\*\*** After installation, apply sealant along top edge of backplate to shed water.
  4. Tie masonry to structural steel columns by welding anchors to columns at 16" o.c. and inserting triangular ties. Ties shall be of the size required to extend a minimum of 1-1/2" into brick veneer, with a minimum mortar cover of 5/8" to the outside face of the veneer.
  5. Where concrete is faced more than 12" high with masonry, bond masonry to concrete with anchors set into dovetail anchor slots cast into the concrete. Provide the anchors. Spacing shall be as specified above for wall ties.
  6. Bond interior masonry walls and the intersection of interior/exterior masonry walls by forming control joints and reinforce with horizontal reinforcing at 16" o.c.
  7. Partitions between rooms without suspended ceilings, and 4" thick partitions with an unsupported length of more than 12 ft. shall be extended to the floor or roof above and wedged and sealed against it. Extend other partitions above the highest adjacent ceiling, unless indicated to extend up to floor or roof above.
- I. 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.
- J. 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.
- K. 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.

- L. Lintels and Beams: Provide lintels and beams for openings in masonry walls. This includes lintels at masonry openings for ducts. Verify duct layouts on the mechanical drawings.
1. Reinforced Masonry Lintels: Construct and reinforce masonry lintels where shown.
    - a. Make concrete masonry lintel units of the same material and by the same process as the other concrete masonry units used in the building.
    - b. Use trough-type units, not regular units with the web knocked out. Fill the troughs with grout.
    - c. Build lintels in place where possible and cure at least 14 days before subjecting them to load. Provide at least 8" bearing at each jamb.
    - d. Where reinforcing is not specifically called out for masonry lintels, use not less than a #4 bar top and bottom of 8" high masonry units for each 4" thickness of wall.
  2. Bond Beams: Provide bond beams in masonry walls. Bond beams shall be continuous where possible. Provide rebar positioners to accurately position reinforcing steel.
  3. Steel Lintels: Build steel lintels into the masonry walls. Where reinforcing or steel shapes are not specifically called out for lintels in brick walls, use one steel angle for each 4" thickness of brick in the wall.
- M. 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.
- N. Weeps: Install weep holes in veneer at 24" o.c. [20" o.c. (king-size brick)] horizontally for clay masonry and 32" o.c. for 16" long concrete masonry, above through-wall flashing, above shelf angles, and at top and bottom of walls. Install plastic weeps in strict accordance with manufacturer's written instructions and recommendations.
- O. 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.
- P. Expansion Joints (Control Joints):
1. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.
  2. At interior masonry walls and intersection of interior/exterior masonry walls, continue horizontal joint reinforcement across control joints.
  3. Provide resilient continuous lengths of control joint material in concrete masonry unit sash blocks. Solvent weld butt and corner joints, in accordance with manufacturer's instructions.
  4. 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.
  5. Reference SECTION 07 95 00 - EXPANSION CONTROL for Preformed, Foam Joint Seals PJS-1.
  6. Interior control joints are not required to align with exterior control joints.
  7. 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.
      - 2) Concrete Masonry Units: Not to exceed a length to height ratio of 1-1/2 : 1 or 25 ft., whichever is less.
    - c. Within 2'-0" of 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.
  8. Control joints shall extend continuous through bond beam although concrete and reinforcement for bond beam shall extend continuous through control joint.



Q. 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.

R. 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.

S. 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.

T. 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.

U. Building Expansion Joints: Discontinue horizontal joint reinforcement across building expansion joints.

V. Non-load-bearing Concrete Masonry Unit Partitions: Partitions which extend up to structure above for fire, acoustical, or security reasons, shall terminate within 2" of structural deck, joists or beams to allow for deflection. Fill 2" gap with sealant and fire safing to achieve proper rating.

### 3.3 PROTECTION

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Maintain protective boards at exposed external corners which may be damaged by construction activities.
- C. Provide protection without damaging completed work.
- D. At the end of each day's work, cover the tops of masonry walls, window sills and jambs, door jambs, and other unfinished exposed cavity wall opening with plastic sheeting or other suitable material. Cover shall extend a minimum of 2' down both sides of walls and shall be held securely in place with Hohmann & Barnard, Inc. Masonry Wall Clamp No. HB3000.
- E. Keep expansion joint voids clear of mortar.

### 3.4 POINT AND CLEAN

- A. Pointing: Upon completion of the masonry work, fill and neatly point line nail holes and other defects. Remove mortar droppings from projecting surfaces.
- B. Cleaning:
1. Clean 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.
- D. Cleaning Existing Interior Masonry:
  1. Lay out and tape down drop cloths to protect existing floor finishes.
  2. Mask adjacent construction elements of construction to protect from water and brick cleaning solutions.
  3. Select and test cleaning solution to be used to clean brick.
  4. Working from the bottom of the wall to the top wet the area of the wall to be cleaned with water.
  5. Using cleaning solution in bucket apply cleaning mixture in accordance with manufacturer's instructions from bucket to wall and clean using a masonry cleaning brush with stiff bristle fibers. Do not use metal brushes.
  6. Clean wall in areas of 20 sq. feet at a time. Rinse wall with clean water.
  7. If stubborn stains are not removed, repeat cleaning process
  8. Rinse with water until rinse water is clear.
  9. Check pH of wall surface and rinse water with pH paper to confirm that pH of wall and water are neutral (pH 6.5 to 7.5) and rinse until pH is neutral.
  10. Test wall surface again 48 hours after cleaning; if pH of wall surface is not neutral then rinse again until neutral.

### 3.5 FIELD QUALITY CONTROL

- A. General: Owner will employ services of an independent materials testing laboratory to perform specified inspections and testing.
- B. Coordinate with Owner's testing laboratory to provide PERIODIC inspection of the following tasks:
  1. As masonry construction begins, and every 5000 sq. ft. during construction, the following shall be verified to ensure compliance:
    - a. Proportions of site prepared mortar.
    - b. Construction of mortar joints.
    - c. Location of reinforcement and connectors.
  2. During construction, the inspection program shall verify:
    - a. Size and location of structural elements.
    - b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
    - c. Specified size, grade, and type of reinforcement and anchor bolts.
    - d. Protection of masonry during cold weather (temperature below 40°F.) or hot weather (temperature above 90°F.).
  3. Prior to grouting at interior non-load-bearing partitions shown in the Architectural drawings, the following shall be periodically verified to ensure compliance:
    - a. Grout space is clean.
    - b. Placement of reinforcement and connectors.
    - c. Proportions of site-prepared grout.
    - d. Construction of mortar joints.
- C. Coordinate with Owner's testing laboratory to provide CONTINUOUS inspection of the following tasks:
  1. Prior to grouting at masonry walls shown on the Structural Drawings, the following shall be continuously verified to ensure compliance:
    - a. Grout space is clean.
    - b. Placement of reinforcement and connectors.
    - c. Proportions of site-prepared grout.

- d. Construction of mortar joints.
- e. Grout placement shall be verified to ensure compliance with code and construction document provisions.

END OF SECTION

**SECTION 051200**

**STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Structural steel.
  - 2. Prefabricated building columns.
  - 3. Shear stud connectors.
  - 4. Shrinkage-resistant grout.
- B. Related Requirements:
  - 1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
  - 2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
  - 3. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other steel items not defined as structural steel.
  - 4. Section 133419 "Metal Building Systems" for structural steel.

**1.3 DEFINITIONS**

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

**1.4 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

**1.5 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Structural-steel materials.
  - 2. High-strength, bolt-nut-washer assemblies.
  - 3. Shear stud connectors.
  - 4. Anchor rods.
  - 5. Threaded rods.
  - 6. Forged-steel hardware.

7. Slide bearings.
8. Prefabricated building columns.
9. Shop primer.
10. Galvanized-steel primer.
11. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
  1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  2. Include embedment Drawings.
  3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
  5. Identify members not to be shop primed.
- C. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### **1.6 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Survey of existing conditions.
- C. Source quality-control reports.
- D. Field quality-control reports.

#### **1.7 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the following specifications and documents:
  1. ANSI/AISC 303.

2. ANSI/AISC 341.
  3. ANSI/AISC 360.
  4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
1. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
    - a. Select and complete connections using schematic details indicated and ANSI/AISC 360 .
    - b. Use Load and Resistance Factor Design; data are given at factored-load level
  2. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.
    - a. Use Load and Resistance Factor Design; data are given at factored-load level

## **2.2 STRUCTURAL-STEEL MATERIALS**

- A. W-Shapes: ASTM A992
- B. Channels, Angles: ASTM A36.
- C. Plate and Bar: ASTM A36.
- D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or ASTM A500, Grade Structural tubing.
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
  1. Weight Class: Standard, Extra strong, Double-extra strong as indicated in the construction documents.
- F. Welding Electrodes: Comply with AWS requirements.

## **2.3 BOLTS AND CONNECTORS**

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.
  1. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125, Grade A490, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
  1. Direct-Tension Indicators: ASTM F959, Type 490-1, compressible-washer type with plain finish.
- C. Galvanized High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
  1. Finish: Hot-dip or mechanically deposited galvanize coating.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

## **2.4 RODS**

- A. Headed Anchor Rods: ASTM F1554, Grade 36 ASTM F1554, Grade 55, weldable.
  - 1. Nuts: ASTM A563 heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A36 carbon steel.
  - 3. Washers: ASTM F436 , Type 1, hardened carbon steel.
  - 4. Finish: Plain Hot-dip zinc coating, ASTM A153, Class C.
- B. Threaded Rods: ASTM A36.
  - 1. Nuts: ASTM A63 heavy-hex carbon steel.
  - 2. Washers: ASTM F436, Type 1, hardened carbon steel.
  - 3. Finish: Plain.

## **2.5 PRIMER**

- A. Steel Primer:
  - 1. SSPC-Paint 23, latex primer.
- B. Galvanized-Steel Primer: MPI#26, MPI#80, MPI#134.
  - 1. Etching Cleaner: MPI#25, for galvanized steel.
  - 2. Galvanizing Repair Paint: SSPC-Paint 20 ASTM A780].

## **2.6 SHRINKAGE-RESISTANT GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## **2.7 FABRICATION**

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1 and manufacturer's written instructions.

- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## **2.8 SHOP CONNECTIONS**

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

## **2.9 GALVANIZING**

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize lintels, shelf angles and any structural steel outside of the building envelope.

## **2.10 SHOP PRIMING**

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces .
  - 6. Corrosion-resisting (weathering) steel surfaces.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
  - 1. SSPC-SP 6 (WAB).
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.



## **2.11 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
  - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E165.
    - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E164.
    - d. Radiographic Inspection: ASTM E94.
  - 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1 for stud welding and as follows:
    - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
    - b. Conduct tests in accordance with requirements in AWS D1.1 on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
  - 5. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

### **3.3 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection[ unless approved by EOR. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

### **3.4 FIELD CONNECTIONS**

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
  1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

### **3.5 REPAIR**

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
  1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

### **3.6 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
  1. Verify structural-steel materials and inspect steel frame joint details.
  2. Verify weld materials and inspect welds.

3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.
    - a. In addition to visual inspection, test and inspect full penetration groove field welds in accordance with AWS D1.1 and the following inspection procedures,
      - 1) Ultrasonic Inspection: ASTM E164.

END OF SECTION 051200

**SECTION 052100**  
**STEEL JOIST FRAMING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

A. Section Includes:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH-series long-span steel joists.
5. DLH-series long-span steel joists.
6. CJ-series composite steel joists.
7. Steel joist girders.
8. Steel joist accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
3. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

**1.3 DEFINITIONS**

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

**1.4 ACTION SUBMITTALS**

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

**1.5 INFORMATIONAL SUBMITTALS**

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

F. Field quality-control reports.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
  - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

## **1.8 SEQUENCING**

- A. Deliver steel bearing plates to be built into cast-in-place concrete or masonry construction.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. New Millennium Building Systems, LLC
- B. Vulcraft; Nucor Corporation, Verco Group

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.
  - 1. Use LRFD; data are given at factored-load level.
  - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
    - a. Floor Joists: Vertical deflection of  $[1/360]$  of the span.
    - b. Roof Joists: Vertical deflection of  $[1/360]$  of the span.

### **2.3 STEEL JOISTS**

- A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
  - 1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
  - 2. K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
  - 3. Provide holes in chord members for connecting and securing other construction to joists.
  - 4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
  - 5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
  - 6. Camber joists according to SJI's "Specifications."

7. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

## **2.4 PRIMERS**

### **A. Primer:**

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

## **2.5 STEEL JOIST ACCESSORIES**

### **A. Bridging:**

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

### **B. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."**

### **C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.**

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.

2. Finish: Plain, uncoated.

### **D. High-Strength Bolts, Nuts, and Washers: Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.**

1. Finish: Plain.

### **E. Welding Electrodes: Comply with AWS standards.**

### **F. Galvanizing Repair Paint: ASTM A780.**

### **G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.**

## **2.6 CLEANING AND SHOP PAINTING**

### **A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.**

### **B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.**

### **C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

#### **A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.**

#### **B. Proceed with installation only after unsatisfactory conditions have been corrected.**

### **3.2 INSTALLATION**

#### **A. Do not install joists until supporting construction is in place and secured.**

- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written instructions, and requirements in this Section.
  - 1. Before installation, splice joists delivered to Project site in more than one piece.
  - 2. Space, adjust, and align joists accurately in location before permanently fastening.
  - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
  - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

### **3.3 REPAIRS**

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Touchup Painting:
  - 1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
    - b. Apply a compatible primer of same type as primer used on adjacent surfaces.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds according to AWS D1.1.
  - 1. In addition to visual inspection, test field welds according to AWS D1.1 and the following procedures, at testing agency's option:
    - a. Ultrasonic Testing: ASTM E164.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

END OF SECTION 052100

**SECTION 053100**  
**STEEL DECKING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Roof deck.
- B. Related Requirements:
  - 1. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
  - 2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
  - 3. Section 099113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
  - 4. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Roof deck.
- B. Sustainable Design Submittals:
  - 1. Provide documentation of how the requirements of Credit will be met:
  - 2. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation including percentages by weight of post consumer and preconsumer recycled content
    - a. Include statement indicating costs for each product having recycled content.
  - 3. Product Data for Credit MR 5.1 and Credit MR 5.2: Submit data, including location and distance from Project of material manufacturer and point of extraction, harvest or recovery for main raw material.
    - a. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
- C. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
- D. Research Reports: For steel deck, from ICC-ES.
- E. Field quality-control reports.

**1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."



## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
  - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
  - 2. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation including percentages by weight of post-consumer and preconsumer recycled content
    - a. Include statement indicating costs for each product having recycled content.

### **2.2 ROOF DECK**

- A. Manufacturers:
  - 1. Canam Steel Corporation
  - 2. Epic Metals Corporation
  - 3. New Millennium Building Systems
  - 4. Nucor Corporation
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 50 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: Gray top surface with white underside.
  - 2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50 zinc coating.
  - 3. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: Gray top surface with white underside.
  - 4. Deck Profile: As indicated.
  - 5. Profile Depth: As indicated.
  - 6. Design Uncoated-Steel Thickness: As indicated.
  - 7. Span Condition: Two span or more.
  - 8. Side Laps: **Overlapped or interlocking seam at Contractor's option.**

### **2.3 ACCESSORIES**

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, as indicated.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.
- G. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: ASTM A780/A780M SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION, GENERAL**

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

#### **3.3 INSTALLATION OF ROOF DECK**

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: as indicated.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
  - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated:
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.

1. Install reinforcing channels or zeos in ribs to span between supports and weld or mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
  1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### **3.4 REPAIR**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
  1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
  2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
  3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

### **3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

**END OF SECTION 053100**

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Lightgauge structural metal studs in exterior wall systems used as backup construction.
- B. Related Sections:
  - 1. Section 05 12 00 - Structural Steel Framing.
  - 2. Section 05 50 00 - Metal Fabrications: steel angles.
  - 3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System.
  - 4. Section 09 21 16 - Gypsum Board Assemblies: non-loadbearing partition studs.

1.2 SYSTEM DESCRIPTION

- A. Masonry Veneer: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/600 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/600, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/600.
- B. Plaster: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/360 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/360, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/360.
- C. All Other Veneer/Cladding: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/240 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/240, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/240.
- D. Interior ramps and platforms fabricated from cold formed metal framing shall be built to withstand a live load of 75 lbs./sq. ft. with no horizontal member supporting plywood subflooring more than 12" o.c.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site prior to commencing Work. Attendees shall include Architect's Structural Engineer, Cold-Formed Metal Framing Engineer, Cold-Formed Metal Framing Installer, and Owner's Testing Lab.

1.4 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's specifications, load tables, dimension diagrams, anchor details, installation instructions for products to be used in lightgauge framing work, and type and location of fasteners. Describe materials and finish, product criteria, and limitations.
- B. Structural Calculations: Submit structural calculations prepared by manufacturer for review by project engineer.
  - 1. Description of design criteria.
  - 2. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application. This shall include cold-formed steel angles around exterior glazing system openings, exterior door openings, and exterior louver openings as detailed.
  - 3. Selection of framing components and accessories.
  - 4. Verification of attachments to structure and adjacent framing components.
  - 5. Sealed by a professional engineer registered in the state where the project is located.
  - 6. Engineer shall have a minimum of 5-years' experience with projects of similar scope.
- C. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Drawings shall incorporate fabrication and erection details.

- D. Evaluation Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

## 1.5 QUALITY ASSURANCE

- A. All structural members shall be designed in accordance with AISI "Specifications for the Design of Cold-Formed Steel Structural Members", latest edition.
- B. Qualifications: Welders and welding procedures shall comply with the requirements of ANSI/AWS D1.3 Structural Welding Code.

## 1.6 DELIVERY AND STORAGE

- A. Protect metal members from rusting and damage. Deliver to project site in manufacturer's containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry, ventilated space.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Lightgage Steel Framing: Basis of Design ClarkDietrich Building Systems (phone 800.543.7140 web site: [www.clarkdietrich.com](http://www.clarkdietrich.com)). ASTM A 1003, Provide Metal Framing, 18 gage minimum with 1-5/8" flange minimum, structural stud framing members. Refer to structural drawings for specific size, type, and locations of framing which may be used on the project.
- B. Substitutions: Under provisions of SECTION 01 62 00 - PRODUCT OPTIONS. Other acceptable manufacturers with products of equal substance and function include:
  - CEMCO Steel
  - MarinoWare
  - Mill Steel Company
  - The Steel Network
- C. Furnish bridging and bracing members shown or required for a complete and structurally sound installation.
- D. Track: Formed steel; channel shaped; same width and finish as studs, tight fit; 18 gage thick, solid web.

### 2.2 ACCESSORIES

- A. Slide Clips: ASTM A 653, Grade A, galvanized metal clip.
  - 1. ASTM A 653, Grade C, galvanized metal clip.
  - 2. Designed and manufactured for attachment of metal stud framing to edge of structural steel framing.
  - 3. Permits differential vertical movement between stud and floor or roof structure.
  - 4. Clip and its connection to structure shall be adequate to safely brace metal studs to resist design lateral load of at least 330 pounds (allowable stress increase permitted by Building Code already taken into account).
- B. Bracing and Furring: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- C. Bridging: 1-1/2" C.R. channels, 16 ga; same finish as framing members.
- D. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- E. Galvanizing Repair Paint: Organic Zinc-Rich coating containing 95% metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD P-21035A for repair of hot-dip galvanizing; as manufactured by ZRC Worldwide (phone 800.831.3275 web site: [www.zrcworldwide.com](http://www.zrcworldwide.com)). Provide Z.R.C. Cold Galvanizing Compound.
- F. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

- G. Glazing System, Door and Louver Perimeter Angle, and other Supplementary Framing:
  - 1. This shall include cold-formed steel angles around exterior glazing system openings, exterior door openings and exterior louver openings as detailed.
  - 2. Fabricate perimeter angle and other steel-framing accessories from ASTM A 1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.
- H. Supplementary Framing: Fabricate other steel-framing accessories from ASTM A 1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.
- I. Slotted Top Track: Sliptrack Systems, SLP-TRK®, (phone 888.475.7875 web site: [www.sliptrack.com](http://www.sliptrack.com)).
  - 1. 16 gage, ASTM A 653, Grade 50 with a minimum yield point of 50,000 psi.
  - 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.

## 2.3 FASTENERS

- A. Self-drilling, Self-tapping Screws, Bolts, Nuts and Washers: ASTM A 90, hot dip galvanized.
- B. Anchorage Devices: Power driven as recommended by manufacturer for size and spacing.
- C. Welding Electrodes: Comply with AWS standards D1.1 and D1.3.
- D. Post-Installed Anchors (for securing perimeter angle to masonry or concrete structure): Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate; zinc coated by hot-dip process according to ASTM A 153, Class C.

## 2.4 FABRICATION

- A. General: Framing components may be prefabricated into panels prior to erection. Cut framing components accurately to fit squarely against abutting members. Hold members firmly in position until properly fastened. Prefabricated panels shall be square and braced against racking. Attach similar components by welding.
- B. Protective Finishing: Paint abraded surfaces and welds after fabrication, using galvanizing repair paint for galvanized surfaces.

## 2.5 FINISHES

- A. All framing members shall be formed from hot-dip galvanized steel, G90 (Z275) coating, conforming to the requirements of ASTM A 1003, Structural Grade, Type H.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. General: Install steel framing members and accessories in accordance with the manufacturer's instructions and the erection drawings. Spacing of studs shall not exceed 16" o.c.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- C. Securely anchor track to floor and overhead structure or member. Seat studs squarely in the track with the stud flange securely attached to the flanges of both upper and lower track.
  - 1. Attach structural components by welding, bolting or with self-drilling screws.
  - 2. Wire tying of framing components in structural applications will not be permitted.

- D. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils. For galvanized surfaces, apply galvanizing repair paint.
- E. Construct corners using minimum three studs. Double stud at wall opening, door, and window jambs.
- F. Provide vertical stud within 12 inches of jamb for brick anchor attachment at openings. Reference BIA Technical Note 28B.
- G. Provide rows of horizontal bridging welded in place at spacing recommended by stud manufacturer to resist lateral forces and stud rotation.
- H. 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.

### 3.2 TOLERANCES

- A. Maximum Variation from True Position:  $\pm 1/8$ " from plan location.
- B. Maximum Variation of any Member from Plane: 1/8" in 10 feet.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Miscellaneous metal work and related items.
- B. Related Sections:
  - 1. Section 05 12 00 - Structural Steel Framing.
  - 2. Section 09 91 00 – Painting: Painted finish of metal fabrications to the extent not specified in this Section.
- C. Make submittals in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- D. Submit product data for nonslip aggregates and nonslip-aggregate surface finishes, prefabricated building columns, sunscreens, slotted channel framing, cast and extruded nosings and treads, paint, and grout.
- E. Shop Drawings:
  - 1. Include details of each metal fabrication, including setting drawings for anchor bolts and other required anchors.
  - 2. For metal fabrications indicated to comply with design loads including but not limited to miscellaneous framing and bracing, columns, elevator machine beams, framing and supports for operable partitions and overhead doors, stairs and railings, floor risers, trench drain frames and covers, metal floor plate and supports, framing and supports for roof-supported gymnasium equipment, and [slotted channel framing][modular channel units], submit shop drawings and structural analysis and calculations signed and sealed by the professional structural engineer responsible for their preparation.
    - a. Engineer shall be registered in the State of Texas.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Carbon Steel: Grade and type designated below for each form required.
  - 1. Shapes, plates, and bars: ASTM A 36.
  - 2. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
  - 3. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M,[ either commercial steel, Type B, or] structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.
  - 4. Steel Tubing, Cold Formed: ASTM A 500.
  - 5. Steel Tubing, Hot Formed: A 501.
  - 6. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
  - 7. Slotted Channel Framing: As specified below.
  - 8. Malleable-Iron Castings: ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).
  - 9. Gray-Iron Castings: ASTM A 48, Class 30 (ASTM A 48M, Class 200), unless another class is indicated or required by structural loads.
- C. Stainless Steel: Grade and type designated below for each form required:
  - 1. Stainless Steel Pipe: ASTM A 312, Grade TP 304.
  - 2. Stainless Steel Tubing: ASTM A 312, Grade MT 304.
  - 3. Stainless Steel Castings: ASTM A 743, Grade CF 8 or CF 20.
  - 4. Stainless Steel Strip, Flat Bars, Plate and Sheet: ASTM A 240 or ASTM A 666, Type 304.
  - 5. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.
  - 6. Stainless Steel Wire Cloth: ASTM A 555, Type 304 wires with mill finish[, 0.177 inches in diameter at 3/4 inch o.c. in both directions and woven in flat top weave].

METAL FABRICATIONS



- 7. Stainless Steel Rolled Floor Plate: ASTM A 793.
- D. Aluminum
  - 1. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
  - 2. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
  - 3. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.
  - 4. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- E. Threaded fasteners:
  - 1. Threaded fasteners for carbon steel fabrications: ASTM A 307, Grade A carbon steel bolts and nuts unless otherwise indicated.
  - 2. Threaded fasteners for stainless steel fabrications, stainless steel railings, aluminum fabrications and aluminum railings: ASTM A 593 bolts and ASTM A 594 nuts fabricated from type 304 stainless steel unless otherwise indicated.
- F. Stud Anchors: Provide headed stud anchors with a smooth shank of carbon steel with a minimum tensile strength of 60,000 psi, as manufactured by Nelson Stud Welding Div. or KSM Welding Systems Div.
- G. Expansion Bolts: Fed. Spec. FF-S-325, Group II, Type A, Class 1. Provide Hilti Kwik-bolt or Ramset Trubolt stud anchors.
- H. Galvanizing Repair Paint: Organic Zinc-Rich coating containing 95% metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD P-21035A for repair of hot-dip galvanizing; as manufactured by ZRC Worldwide, Marshfield, MA (phone 800.831.3275 web site: [www.zrcworldwide.com](http://www.zrcworldwide.com)). Provide Z.R.C. Cold Galvanizing Compound.

## 2.2 FABRICATION

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
  - 1. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
- B. Fabricate and assemble metal work in the shop to the greatest extent possible.
  - 1. Metal surfaces shall be clean and free of mill scale and rust pitting, well-formed to shape and size with sharp lines and angles. Shearing and punching shall leave clean true lines and surfaces. Exposed ends and edges shall be milled smooth with corners slightly rounded.
  - 2. Weld shop connections to the extent practical; finish exposed welds smooth. Weld joints shall be flush.
  - 3. Cut, drill or punch holes; do not make or enlarge by burning. Provide holes where required for connecting the work of other trades.
  - 4. Conceal fastenings where practical. Thickness of metal and method of assembly and support shall give ample strength and rigidity.
  - 5. Assemble parts so that joints are tight, members are in good alignment, and the finished work reproduces the drawing details as intended.
  - 6. Stud Anchors: Weld stud anchors to miscellaneous shapes using welding equipment and procedures recommended by the manufacturer of the stud anchors used.
- C. Punching: Provide holes where required for connecting the work of other trades.
  - 1. Cut, drill or punch holes; do not make or enlarge by burning.
  - 2. At hollow structural sections located in the exterior building envelope, provide shop-punched holes in steel sections as indicated on drawings, for installation of sprayed foam insulation to completely fill hollow structural section cavity.
- D. Connection Plates: Drill bolt holes maximum of 1/16" larger than bolt diameter. If larger holes are needed for erection purposes weld plate washers to connection plates to transfer bolt load.
- E. Welding: Conform to AWS D1.1 and D1.3 as applicable. Tack welds are prohibited on exposed surfaces.
- F. Install washers where shown; tighten nuts and nick bolt threads.

- G. Do not cut sections of structure including flanges, webs, plates, or angles without written permission of Architect, or unless shown on the approved Shop Drawings.
- H. Isolate dissimilar metals with bituminous paint or non-absorptive gasket to prevent contact.
- I. Shop Painting:
  - 1. Non-galvanized ferrous metals: Clean, degrease, and apply shop coat of straight alkyd, zinc chromate, rust inhibitive paint applied by brush or spray.
    - a. Surface Preparation:
      - 1) Interior and concealed steel: Clean by SSPC-SP3 Power Tool Cleaning.
      - 2) Exterior and all AESS steel: Clean by SSPC-SP6 Commercial Blast cleaning.
    - b. Apply primer according to manufacturer's written instructions.
    - c. Omit painting of steel to be encased in concrete and steel bearing surfaces.
  - 2. Aluminum: Shop-apply coat of zinc chromate primer to aluminum surfaces to be in direct contact with concrete or masonry.
- J. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows:
  - 1. ASTM A 153 for galvanizing iron and steel hardware.
  - 2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch thick and heavier, and for galvanizing assembled steel products.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION AND PREPARATION:

- A. Provide templates for setting of anchors, anchor bolts, and bearing plates. Create templates for field-drilled adhesive and expansion anchor connection location prior to drilling holes in connection plates.
  - 1. Locate concrete reinforcement using a pachometer prior to making template.
  - 2. Anchors may be repositioned up to 1-1/2 inches from location indicated to avoid conflict with reinforcing.

#### 3.2 INSTALLATION

- A. Deliver, store, and erect metal work in such manner that the parts are not damaged or deformed. Install the work true to line, plumb, level, in proper alignment with other work, and free of sags, buckles, and other objectionable defects. Anchorage shall be adequate to safely resist all stresses to which the work will normally be subjected.
- B. Connections: Weld or bolt as indicated and according to approved Shop Drawings.
  - 1. Install drilled expansion and adhesive type anchors perpendicular to face of concrete. Deviation greater than 10 degrees from vertical is not acceptable.
    - a. Drill holes in concrete in a continuous operation. Clean holes with a wire brush and blow dust from holes with compressed air.
    - b. Drill holes in concrete same nominal diameter as bolts. Do not enlarge or redirect along the length.
    - c. Fill abandoned and unused holes with epoxy grout.
    - d. Aim wedges away from concrete edges closer than 9 inches to centerline of holes. Tighten nuts against smooth washers to maximum torque recommended by Bolt Manufacturer.
- C. Provide temporary bracing and fasteners to hold parts until attachment is complete.
- D. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
  - 2. Apply primer to all uncoated nuts, bolts, and other miscellaneous steel items installed without shop-applied primer.
  - 3. For galvanized surfaces, apply galvanizing repair paint.

#### 3.3 FIELD QUALITY CONTROL:

- A. Inspect drilled holes for expansion and adhesive type anchors to verify they are of proper diameter and depth.

- B. Brace structure for applied construction and wind loads encountered during all stages of erection to maintain work in a safe and stable condition.
  - 1. Structural steel superstructure will not be laterally self-supporting until roof diaphragms and connections to all lateral load restraining elements are in place.
  - 2. Provide temporary bracing and fasteners as necessary to hold fabrications until attachment is complete.
- C. Owner's Testing Lab will provide required inspections and testing. Refer to Section 01 45 23 - TESTING AND INSPECTION SERVICES.

### 3.4 MISCELLANEOUS METAL SCHEDULE

- A. General: The following is a general list of the metal work to be furnished under this section of the specifications. Other items of miscellaneous metal work shown and noted on the drawings and not mentioned elsewhere in the specifications shall be furnished as though specifically described herein.
- B. Loose Lintels: Lintels of steel shapes and plates where required at exterior brick veneer and as detailed.
  - 1. End bearing shall be at least 8".
  - 2. Where steel lintels are not specifically called out, furnish at least one steel angle for each 4" thickness of masonry in the wall.
  - 3. Wrap bearing ends of lintels with flashing to achieve a bond breaker between the lintel and the masonry.
  - 4. Galvanize steel lintels located in exterior walls.
- C. Roof Curbs: Refer to Section 07 72 13 - *Manufactured Roof Curbs and Portals*.
- D. Roof Edge Angles: Provide steel angles along roof edges to support wood nailers.
  - 1. Weld angles to steel framing unless otherwise indicated.
- E. Bracing for Aluminum-Framed Entrances and Storefronts: Provide braces of steel angles, channels, and plates to reinforce and stiffen the head of the aluminum storefront framing.
- F. Bracing for Aluminum Curtain Wall System: Provide miscellaneous steel shapes, weldments, clips, connectors, shims, and fasteners required to resolve reactions from loads imposed by curtain wall system into primary structural system of building.
  - 1. Apply primer and finish coats to all bracing members exposed to view in accordance with requirements of Section 09 91 00 - Painting.
- G. Track Supports: Provide framing and brackets of steel shapes as detailed to support curtain track, accordion folding partition, folding panel partition, or overhead barrier-free lift track.
  - 1. Erect to be level, straight and rigid.
  - 2. Punch for mounting bolts as required.
- H. Steel Pipe Stage Lighting Support Rails: Light support rail of standard black steel pipe with fittings as detailed for the lighting pocket in the ceiling.
  - 1. Hang the support rail from the structure above with braced pipe struts spaced 48" o.c. Rail shall be straight and level.
  - 2. Furnish slip flanges where pipe struts penetrate gypsum board ceiling.
- I. Cast Iron Gratings: Standard duty cast iron gratings and frames of the type and size detailed for the concrete catch basins and tree grates.
  - 1. Set frames flush with the concrete and loose in the frames at catch basins.
- J. Ladders: Fabricate ladders of steel bars and shapes.
  - 1. Weld all connections.
  - 2. Bolt ladders to floor and wall with steel brackets and clips.
  - 3. Ladder Rungs: Provide SlipNOT®, grit-free, mill finish steel Grade #2 – Medium rungs as manufactured by the W.S. Molnar Company (1-800-SlipNOT) or approved equivalent. Reference drawings for dimensions. Steel shall incorporate an anti-slip primarily martensitic steel surface covering 100% of the substrate consisting of a random hatch matrix with a surface hardness between 55 – 63 on the Rockwell "C" scale, and a surface to substrate bond strength of at least 4,000 psi. The non-slip surface shall have a minimum coefficient of friction of 0.8 and be listed as slip resistant by Underwriters Laboratories.

4. Galvanize exterior ladders after fabrication. Reference Manufacturer's galvanizing guidelines, as to not damage the anti-slip surface.
- K. Bollards:
1. Cast-in-place: Provide bollard sizes indicated.
    - a. Fabricate of Schedule 40 steel pipe, galvanized with G90 coating.
    - b. Install bollards and footings in paved areas before paving is installed, as indicated on the Drawings.
    - c. Extend bollards 3 feet below grade and 4 feet above grade, Hold bollard 6 inches above bottom of footing hole.
    - d. Fill hole and bollard with 3000 psi concrete and finish with domed top.
  2. Surface mounted: Fabricate bollards with minimum 12" x 12" x 3/8"-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4" anchor bolts.
  3. Removeable bollards:
    - a. Product: S4 Bollards No. RPCS4040-ESV40; Source4 Industries, Las Vegas, NV; website [www.source4industries.com](http://www.source4industries.com); phone (866) 734-8848).
    - b. Description:
      - 1) Bollard: 4" Schedule 40 carbon steel pipe (nominal 4-inch diameter x 0.237 inch wall thickness) x 36 inches in height above finished surface and with domed steel top.
        - a) Finish: Hot dip galvanized with manufacturer's standard powder-coat finish (yellow).
      - 2) Embedment: Stainless steel embedment sized to accept removeable bollard and provided with a hinged stainless-steel lid that is flush with top of embedment when closed; bollard is lockable to embedment with Owner-provided padlock.
    - c. Installation: Cast embedment into concrete plumb and in accordance with manufacturer's instructions. Allow concrete to cure for not less than 7 days prior to installation of removeable bollards.
- L. Fence (Shop fabricated): Provide fence of structural steel shapes including tubes, plates, and channels, with frame, rails, and pickets of the sizes and spacing as detailed.
1. Miter corners and weld all connections.
  2. Grind all welds smooth.
  3. Hot-dip galvanize fence panels and posts with G90 coating after fabrication.
  4. Paint fences provided under this Section indicated to be painted in accordance with requirements of Section 09 91 00 Painting.
  5. Installation: Install fence including posts and panels plumb, erect and straight with concrete foundations as detailed.
- M. Gates (Shop fabricated): Provide gates of structural steel shapes including tubes, plates, and channels, with frame, rails, and pickets of the sizes and spacing as detailed. Miter corners and weld all connections. Grind all welds smooth.
1. Hot-dip galvanize gates with G90 coating after fabrication.
  2. Paint gates provided under this Section indicated to be painted in accordance with requirements of Section 09 91 00 Painting.
  3. Installation:
    - a. Where frames are shown anchored to wall, anchor to masonry wall with adjustable anchors to fit masonry joints.
    - b. Where gates are shown to be hung from posts, set posts plumb into concrete foundations as detailed. Allow concrete to obtain specified 28-day strength before hanging gates.
    - c. Installation: Install hardware and hang the gates. Adjust gates to operate smoothly and easily. Make gates secure against entry when locked.
  4. Gate Hardware:
    - a. Swing Gates: Hardware as shown by Drawings and as follows:
      - 1) 4 pr. butts BB852 5 x 6 USP - Stanley
      - 2) 1 padlock 756 6 pin - Sargent
      - 3) 1 safety hasp SP917 - Stanley
      - 4) 1 cane bolt 1010 18" - Stanley
    - b. Rolling Gates: Hardware including rollers, cushions, guides, cane bolts and the like as shown by Drawings and as follows:
      - 1) Rubber Cushion Stops
      - 2) Non-marring guide rollers at top of gate, size as shown by Drawings.
      - 3) Weight-Bearing Wheels: Elite Power Wheel AH112, 5" diameter steel v-groove wheel with sealed bearings and mounting bracket
      - 4) Cane bolt: 1010 18" - Stanley
      - 5) Locking hardware as selected by Architect.

- N. Brick Vents: Provide aluminum brick vents 2-1/2"W x 3-5/8"D x length indicated on drawings, as manufactured by Construction Specialties, Inc.
- O. Roof Edge Angles: Provide steel angles along roof edges to support wood nailers.  
1. Weld angles to steel framing unless otherwise indicated.
- P. Structural Steel Door Frame for Jamb Mounted Rolling Doors: Frames of carbon steel shapes, bars and plates, fully welded, uniform, square, and true, as detailed for the rolling doors.  
1. Miter and weld corner joints and grind exposed welds smooth.  
2. Weld 14 gage strip anchors to frame jambs, spaced 24" o.c. to work masonry bed joints.  
3. Continuously weld exposed joints; grind exposed welds smooth.  
4. Provide necessary reinforcements and drill and tap as required for finish hardware.  
5. Provide steel strap anchors for securing door frames into adjoining masonry. Weld anchors to frame jambs no more than 12" from both bottom and head of frame and space anchors not more than 30" apart.  
6. Galvanize exterior structural steel door frames and anchors.
- Q. Downspouts: 6" x 6" x 3/16" thick steel tubing fabricated per details.  
1. Hot-dip galvanized, paint grip G90, entire assembly per ASTM A 123 Class B-1, with a minimum of 0.2 oz. per sq. ft. surface.
- R. Downspout Nozzles: Clear Anodized Josam, 25010 Series, or other Manufacturer's product approved by Architect.  
1. Clear anodized downspout nozzle with loose flange and inlet threaded connection. :  
2. Provide at end of concealed downspout piping at building face.
- S. Cast Iron Downspout Boots: Provide B25 Series (rectangular) or B26 Series (round) cast iron downspout boots as manufactured by BarryCraft by Barry Pattern & Foundry or approved equivalent. Provide sizes and configurations indicated on drawings. Boots shall be factory primed.
- T. Trench Covers: Provide cast-iron, heavy-duty trench drain and cover, # TGMB-10 x 10 LF, as manufactured by McKinley Iron Works.
- U. Slotted Channel Framing (to the extent not specified in Division 21 Fire Protection, Division 22 Plumbing, Division 23 HVAC, and Division 26 Electrical sections): Slotted channel framing designed by Professional Structural Engineer licensed in jurisdiction where Project is located, consisting of cold-formed manufacturer's standard metal box channels fabricated from steel complying with ASTM A 653/A 653M, Grade 33 structural quality with flange edges returned toward web and with slotted holes in webs at 2 inches o.c., and finished with manufacturer's standard thermoset acrylic coating finish. Provide all fittings, bolts, and nuts required for assembly. Anchor to building structural system to suit equipment, building components and assemblies, and systems supported by slotted channel framing using manufacturer's standard components and fasteners.  
1. Product: Unistrut Corp.: Unistrut with Perma-Green finish or equivalent products of one of the following manufacturers:  
Anvil International: Anvil-Strut.  
ABB / Thomas and Betts: Superstrut.  
Carpenter and Paterson Inc.: Multistrut.  
Eaton Corporation: Eaton B-Line.  
Pentair: Eristrut Strut Channel System.  
Haydon Corp.: H Strut.  
Unitron Products Inc.: US-Strut.  
Wesamco Inc.: Westrut.  
2. Installation:  
a. Installation shall be only by fully trained and manufacturer's authorized installer.  
b. Install slotted channel framing to comply with requirements of items being supported.  
c. Set slotted channel framing components into final position true to line, level and plumb, in accordance with approved shop drawings.  
d. Do not anchor slotted channel framing to permanent metal forms, floor deck, steel deck tabs, or steel roof deck.  
e. Anchor slotted channel framing firmly in place to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, power-actuated fasteners that extend through forms into concrete, or to structural members, and tighten all connections to recommended torque.

- V. Steel Frames at Roof Penetrations:
1. For penetrations through the roof, including but not limited to skylights, roof hatches, exhaust fans and other roof mounted equipment, and ductwork, where a header is not required to carry structural members, and where either opening width or length do not exceed 4 feet, provide frame fabricated from steel angles sized to carry imposed loads but not smaller than L-4"x4"x1/4". Provide frames that completely surround all such penetrations. Weld all connections of frame members. Set steel angle frames directly on joists and/or rolled structural steel shapes of roof structural system and anchor by welding. Do not set frames on deck.
  2. For openings at penetrations where a header is required to carry one or more structural members, or opening dimension is larger than 4 feet in either width or length, refer to Structural Drawings and Specifications.
- W. Miscellaneous Steel Shapes: Channels, wide flange shapes, angles, plates, tubing, connections, and bolts where shown and detailed on Drawings. Hot-dip galvanize where exposed to weather or touching exterior masonry after fabrication.

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Wood blocking and nailers, and plywood backing panels.
- B. Related Sections:
  - 1. Section 06 40 00 - Architectural Woodwork.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Product Data:
  - 1. Include all data for rough carpentry products required for installation.
  - 2. Fire-retardant-treated wood product data, including certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.
- C. Warranty: Provide warranty of chemical treatment manufacturer for each type of treatment.

1.3 QUALITY ASSURANCE

- A. Lumber Grading: Lumber Grading Rules and Wood Species in accordance with Voluntary Product Standards. Grading rules of following associations apply to materials furnished.
  - 1. Southern Pine Inspection Bureau (SPIB).
  - 2. West Coast Lumber Inspection Bureau (WCLIBB).
  - 3. Western Wood Products Association (WWPA).
- B. Grade Marks: Identify lumber and plywood by official grade mark.
  - 1. Lumber: Include symbol of grading agency, mill name, grade, species, grading rules and condition of seasoning at time of manufacturer.
  - 2. Plywood: Include type, span rating or group number, exposure durability classification, and agency mark of APA.

1.4 QUALIFICATIONS

- A. Design structural site fabricated items under direct supervision of a professional structural engineer experienced in design of this work and licensed in the State of Texas.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- B. Store products above ground, on platforms or skids, and covered with waterproof coverings. Provide for adequate air circulation.
- C. Do not store seasoned materials in damp or wet locations.
- D. Support products in such a way as to prevent warping and distortion.

1.6 WARRANTY

- A. Provide a 20-year warranty for each type of chemical treatment.



## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Wood: Lumber for framing and general carpentry work shall be sound, well manufactured, surfaced S4S material with a moisture content limit of 19%.
  - 1. Dimension: SPIB grade marked No.2 Dimension Southern Pine or WCLB grade marked No. 2 Dimension Douglas Fir.
  - 2. Boards: SPIB grade marked No. 2 Boards Southern Pine.
  - 3. Redwood: RIS grade marked Construction Heart California Redwood.
- B. Plywood: Plywood for general carpentry work shall be APA trademarked, 23/32" minimum thickness, Tongue & Groove.
  - 1. Interior: B - D, Group 2, Exposure 1, fire-retardant treated.
  - 2. Exterior: C - C plugged grade, Group 2, Exterior type, fire-retardant treated.
- C. Rough Hardware:
  - 1. Anchors, bolts, screws, and spikes shall be of proper types and sizes to support the work, to draw the members into place, and to hold them securely. Bolt heads and nuts bearing on wood shall have standard washers.
  - 2. Metal fasteners to secure wood grounds and blocking to masonry and concrete shall be of the type best suited to the conditions and spaced no more than 16" o.c. Wood plugs and nailing blocks are not acceptable.
  - 3. Nails shall be of the sizes and types intended for the particular use.
  - 4. Rough hardware exposed to the weather or embedded in exterior masonry and concrete walls or slabs shall be hot-dipped galvanized.
  - 5. Nails and bolts used with preservative treated lumber shall be hot-dipped galvanized.

### 2.2 WOOD TREATMENT

- A. Preservative Treatment:
  - 1. Comply with applicable requirements of AWP Standards C2 (Lumber and C9 (Plywood).
  - 2. Mark each treated item with the AWPB Quality Mark Requirements.
  - 3. Above-ground items:
    - a. Pressure treat with waterborne preservatives complying with AWPB LP-2; after treatment, kiln-dry to maximum moisture content of 19% for lumber and 15% for plywood.
  - 4. Application: Treat items indicated on drawings, and the following:
    - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in exterior locations including but not limited to nailers in connection with roofing, flashing, vapor barriers, and waterproofing.
    - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete, and similar members.
  - 5. Ground contact: Pressure treat with waterborne preservatives for ground contact use complying with AWPB LP-22.
- B. Fire-Retardant Treatment: (All wood products except roof blocking)
  - 1. Provide fire treated wood and plywood complying with AWP standards for pressure impregnation with fire-retardant chemicals.
  - 2. Kiln-dry treated items to maximum moisture content of 19% for lumber and 15% for plywood.
  - 3. Treat all wood framing members, blocking, stripping, and similar members.
  - 4. At Interior and Substrate Locations: Wood shall be fire-retardant chemically treated and pressure impregnated; with a flame spread index of 25 or less and a smoke development of 0-450 when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test. Treat in accordance with AWP C20 for lumber and C27 for plywood and particleboard.
  - 5. Use treatment that does not promote corrosion of metal fasteners.
  - 6. At Exposed Exterior Locations: Wood and plywood shall be treated with Exterior Fire-X Blue as manufactured by Hoover Treated Wood Products (phone 800.531.5558, [www.frtw.com](http://www.frtw.com)). Provide UL label on each piece of fire-retardant lumber or plywood.
  - 7. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
  - 8. Application: Treat items indicated on Drawings, and the following:
    - a. Concealed miscellaneous lumber, blocking and nailers.
    - b. Telephone and electrical equipment backing panels.

- C. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying; discard damaged or defective pieces.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General
  - 1. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
  - 2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Scribe and cope as required.
  - 3. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards and as required to draw members into place and securely hold same unless otherwise indicated. Use washers under all bolt heads.
  - 4. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
  - 5. Make tight connections between members to develop full strength of members.
  - 6. Pre-drill as necessary and install fasteners without splitting wood.
  - 7. Comply with APA E30 requirements for plywood.
  - 8. Install fasteners at spacings recommended by AFPA National Design Specifications for Stress Grade Lumber and Its Fastening - 1973 for lumber and APA Guide E30 for Plywood, unless more restrictive code requirements dictate tighter spacing or heavier fasteners.
- B. Blocking: Install 2x6 wood blocking between studs to stiffen the structure and for the support of other work. Provide 2x6 wood blocking for installation of wall-mounted objects.
- C. Nailers: Install nailers of adequate size where detailed. Bolt nailers in place. Where bolt sizes and spacing are not specifically noted, use not less than 3/8" bolts at 32" o.c., staggered.
- D. Floor Underlayment for Platform Treads and Risers: Install plywood underlayment with face grain perpendicular to supports and spanning minimum two spans. Locate ends and sides over supports and stagger the short joints. Leave 1/8" spacing between all panel ends and edges. Use screw-type nails on 6" centers at ends and 12" centers at intermediate supports. Set screw heads 1/16". Start nails 3/8" from panel edges. Nail and glue using adhesives meeting APA specification AFG-01 or ASTM D 3498, with installation per APA's Form E30.
- E. Plywood Backing Panel Installation: Install telephone and electrical equipment backing panels with higher grade face exposed to view. Coordinate with requirements of Division 26 Sections.
  - 1. Screw attach panels through gypsum board to supports.
  - 2. Attach panels to hollow masonry with 1/4-inch toggle bolts.

#### 3.2 PROTECTION

- A. Protect products from moisture absorption and subsequent warping or deterioration until subsequent construction can proceed.

END OF SECTION

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SECTION 06 16 56

AIR- AND WATER-RESISTIVE SHEATHING BOARD SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Vapor-permeable, air- and water-resistive wall sheathing.
  - 2. Site-fluid-applied, vapor-permeable air barrier flashing.
  - 3. Accessories.
- B. Related Sections:
  - 1. Section 01 45 00 - Quality Control: for general mockup requirements.
  - 2. Section 01 45 23 - Testing and Inspection Services: for coordination with testing agency.
  - 3. Section 05 40 00 - Cold-Formed Metal Framing: for structural framing support of panels.
  - 4. Section 06 10 00 - Rough Carpentry: wood blocking and nailers.
  - 5. Section 07 11 13 - Bituminous Dampproofing: behind below-grade masonry veneer and at non-conditioned buildings.
  - 6. Section 07 27 26 - Fluid-Applied Membrane Air Barriers: air barrier on masonry backup.
  - 7. Section 07 65 00 - Flexible Flashing: for flexible flashing components integrating with transition materials specified in this Section.
  - 8. Section 07 92 00 - Joint Sealants: for backing materials.
  - 9. Division 07 roofing Sections for roof assembly air barriers and interface coordination.

1.2 DEFINITIONS

- A. Air barrier Accessory: A transitional component of the air barrier that provides continuity.
- B. Air barrier Assembly: The collection of ABs and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- C. Air barrier Material (AB): Air tight barrier made of material that is relatively air impermeable but moisture vapor permeable, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.
- D. Material Transitions: Areas where the WRB/AB fiberglass-mat gypsum sheathing connects to beams, columns, slabs, parapets, foundation walls, roofing systems, and at the interface of dissimilar materials.
- E. Rough Openings: Openings in the wall to accommodate windows and doors.
- F. Water-Resistive Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, and installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate installation of board product air barriers with framing installation and subsequent operations that impact finished envelope air barrier work.
  - 2. Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.
- B. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review board product air barrier accessory materials installation, including joints between sheathing boards and transitions to abutting construction including air barriers work of other Sections. Review requirements for forming and sealing penetrations of air barrier by other trades.
  - 2. Review requirements for each type of air barrier product and installation, project and manufacturer's details, mockups, testing and inspection requirements, and coordination and sequencing of air barrier work with work of other Sections.
  - 3. Review manufacturer's written instructions for meeting Project requirements for substrates specified, including three-dimensional video model demonstrating proper application of components at wall openings.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of air barrier product assembly and accessory. Indicate assembly component materials and dimensions and include construction and application details.
  - 1. Include data for framing preparation instructions and recommendations.
  - 2. Include data for substrate preparation instructions and recommendations.
  - 3. Include data for air- and water-resistive sheathing board assembly product data.
  - 4. Include standard drawings illustrating manufacturer's written installation and finishing instructions applicable to Project, including details for joints, counterflashings, penetrations, terminations, and tie-ins to adjacent construction.
- B. Shop Drawings: For locations and extent of WRB/AB system.
  - 1. Include details of typical conditions, special joint conditions, and intersections with other building envelope systems and materials.
  - 2. Include counter flashings and details showing bridging of envelope at substrate changes.
  - 3. Detail sealing penetrations, and flashing around windows and doors.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Product Certificates: Indicate compliance with requirements of specified products under Performance Requirements or indicated on Drawings.
- C. Fire-Propagation Characteristics Certificate: From a qualified testing agency, documentation that air barrier system as a component of a wall assembly has been tested or engineered to pass NFPA 285. Include system classification number of testing agency on Shop Drawings.
- D. Product Certificates: Indicate compliance with requirements of specified products in "Performance Requirements" Article or as indicated on Drawings.
- E. Product Test Reports: For each air barrier product, and air- and water-resistive sheathing board assembly, for tests performed by a qualified testing agency.
- F. Sample Warranties: For manufacturer's warranties.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified air barrier manufacturer experienced in manufacture of air barrier as one of its principal products.
- B. Installer Qualifications: An experienced entity that employs applicators trained in application of specified products.
- C. Testing Agency Qualifications: Qualified independent agency experienced in installing specified waterproofing system, and qualified to perform observation and inspection specified in "Field Quality Control" Article to determine Installer's compliance with the requirements of this Project. Testing agency to be acceptable to Architect and retained by the Owner.
- D. Mockups: Provide air barrier mockup application within mockups required in other Sections, or if not specified, in an area of not less than 64 sq. ft. of wall surface where directed by Architect for each type of backup wall construction. Include examples of surface preparation, crack and joint treatment, air barrier application, and flashing, transition and termination conditions. Build mockups to set quality standards for materials and execution.
  - 1. Include air barrier system tie-in details between walls and roof, and with wall and foundation wall. Include penetrations and openings.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packaging and store in an enclosed shelter providing protection from damage and exposure to the elements.
  - 1. Store within temperature limits required by manufacturer.
  - 2. Store air- and water-resistive sheathing board supported on risers on a flat platform.

3. Comply with manufacturer's written instructions requirements for safety and handling.
- B. Discard liquid materials that cannot be applied within their stated shelf life.
- C. Store accessory materials in a location with constant ambient temperatures of 40 to 80 deg F.

## 1.8 FIELD CONDITIONS

- A. Cold Weather Conditions:
  1. Site Fluid-Applied, Vapor-Permeable Joint Flashing: Comply with manufacturer's cold weather application written instructions when atmospheric temperatures or substrate surface temperatures are less than 40 deg F.
  2. Accessories and Sealants: Comply with manufacturer's cold weather application instructions when atmospheric temperatures or substrate surface temperatures are less than 40 deg F.
- B. Exposure: Comply with manufacturer's limitations on exposure of applied product.
  1. Do not apply air barrier joint flashing to sheathing surface that is frozen or has frost.
- C. Protect adjacent substrates from environmental conditions that affect air barrier performance
- D. Coordinate installation of membrane air barrier with completion of roofing, below grade, factory fluid-applied membrane portion to site fluid-applied membrane portion and other work requiring interface with air barrier.
- E. Schedule work for inspection of air barrier applications prior to concealment.
- F. Ensure ABs are cured before covering with other materials.

## 1.9 WARRANTY

- A. Manufacturer's Warranty for Air Barrier System:
  1. Warranty Period for Air- and Water-Resistive Sheathing Board Assembly: Watertight for a period of ten years from date of Substantial Completion.
- B. Manufacturer's Warranty for Site Fluid-Applied Air Barrier Products: Manufacturer agrees to furnish and install AB to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as a water-resistive barrier and air barrier, as defined in the applicable IBC and IECC, under normal use within specified warranty period.
  1. Manufacturer will, at its option, replace nonconforming Product or refund the purchase price of quantity of product shown to be nonconforming.
  2. Access for Repair: Provide air barrier system manufacturer with unimpeded pre- and post-occupancy access to Project facility and air barrier system for purposes of testing, leak investigation, and repair, and to reinstall removed cladding materials upon completion of repair.
  3. Warranty Period: Ten years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Source Limitations: Obtain fluid-applied flashing materials and air barrier accessories from single source from single manufacturer.
- B. Low-Emitting Materials: Fluid-applied flashing and accessories shall comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.2 PERFORMANCE REQUIREMENTS

- A. Air- and Water-Resistive Performance: Air- and water-resistive board assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier system and as a water resistive barrier flashed to direct incidental water to wall exterior, and interface with adjacent building air barrier system components.
  - 1. Air- and Water-Resistive Board Assemblies: Capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air-leakage exceeding specified limits.
- B. Air Permeance of Sheathing: Maximum 0.04 cfm/sq. ft of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2178.
- C. Air- and Water-Resistive Board Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.
- D. Water Penetration under Static Pressure: Test according to ASTM E 331, as follows:
  - 1. No evidence of water penetration through air barrier board assembly when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 2.86 lbf/sq. ft.
- E. Water Vapor Permeance; Panel Assembly: Minimum 10 perms (580 ng/Pa x s x sq. m) as tested according to ASTM E 96/E 96M, Procedure B.
- F. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a qualified testing agency.
- G. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- H. Fire Propagation Characteristics: Provide air- and water-resistive board assembly qualified as a component of a comparable wall assembly that has been tested or engineered to pass NFPA 285.

## 2.3 WALL SHEATHING

- A. Air- and Water-Resistive Sheathing Board: ASTM C 1177/C 1177M, glass-mat-faced gypsum sheathing board.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DensElement™ Barrier System as manufactured by Georgia-Pacific Gypsum LLC.; or a comparable product by one of the following:  
USG Corporation and Tremco; Securock ExoAir 430 System.  
NO SUBSTITUTIONS.
  - 2. Board Thickness: 5/8 inch thick.
  - 3. Board Type: Type X.
  - 4. Board Size: 48 by 96 inches for vertical and horizontal installations.
  - 5. Air- and water-resistive Flashing Thickness: Minimum 16 mils wet film thickness.
  - 6. Physical and Performance Properties:
    - a. Air Permeance; ASTM E 2178: Maximum 0.04 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference.
    - b. Water Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Procedure B.
    - c. Combustion Characteristics; ASTM E 84: Class A.
    - d. Board Product Antifungal Properties; ASTM D 3273: 10; zero defacement.
    - e. VOC Content - Fluid-Applied Flashing: 50 g/L or less.
    - f. UV and Weathering Resistance: Maximum 12-month exposure.

## 2.4 AIR BARRIER ACCESSORY MATERIALS

- A. General: Provide compatible air barrier accessory materials furnished or recommended by air barrier manufacturer as required by Project conditions to produce a complete air barrier assembly identical to tested assemblies meeting performance requirements.

- B. Joint Backing: See SECTION 07 92 00 - JOINT SEALANTS for backing materials.
- C. Primer: Liquid primer recommended by air barrier manufacturer for exposed gypsum core edges.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc.; PorousPrep Sealer.
  - 2. Color: Blue.
- D. Fluid-Applied Air Barrier Flashing: Site-applied for application to joints, fasteners, penetrations, openings, and material transitions.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DensDefy Liquid Flashing as manufactured by Georgia Pacific Gypsum LLC.
  - 2. Color: Gold
- E. Flashing and Transition Strip: Self-adhered membrane, 25 mils thick.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide DensDefy Transition Membrane as manufactured by Georgia Pacific.

## 2.5 FASTENERS

- A. Screws for Fastening Board Product Air barriers to Cold-Formed Metal Framing: Steel drill screws, ASTM C 1002, in length recommended by sheathing manufacturer for sheathing thickness.
- B. Screws for Fastening Board Product Air Barriers to Wood Framing: Wood screws, ASTM C 1002, in length in accordance with sheathing manufacturer's written instructions for sheathing thickness

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Framing Examination: Examine framing to determine if work is ready to receive board product air barriers.
  - 1. Verify that surface flatness tolerances and framing spacing comply with Project requirements.
  - 2. Verify that adequate support is provided for sheathing board edges.
  - 3. Proceed with work once conditions comply with manufacturer's written instructions.
- B. Adjacent Substrate Examination: Prior to installation of accessory materials, examine adjacent substrates to receive transition treatment.
  - 1. Verify that substrates are sound and free of contaminants, adequately cured or aged, compatible with proposed transition materials, and free of obstructions or impediments that would result in failure of transition adhesion and failure of air barrier assembly to perform according to Project requirements.
  - 2. Verify that concrete and masonry surfaces are visibly dry, cured, and free from release agents, curing agents, and other contaminants.
    - a. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  - 3. Verify that masonry joints are filled with mortar and struck flush.
- C. Proceed with installation once conditions comply with manufacturer's written instructions and only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean, prepare, and treat portions of work not requiring sheathing board substrate according to air barrier manufacturer's written instructions.
  - 1. Mask adjacent finished surfaces.
  - 2. Remove contaminants and film-forming coatings from substrates.
  - 3. Remove projections and excess materials; fill voids with substrate patching material.
  - 4. Prepare and treat joints and cracks in substrate according to air barrier manufacturer's written instructions.
- B. Joints:
  - 1. Seal all sheathing joints with fluid-applied flashing approved by sheathing manufacturer.
  - 2. Fill gaps from 1/8 to 1/4 inch with a backer rod prior to applying fluid-applied flashing.
  - 3. Seal gaps greater than 1/4 inch with transition membrane and fluid-applied flashing approved by sheathing manufacturer.



### 3.3 INSTALLATION OF AIR- AND WATER-RESISTIVE SHEATHING BOARDS

- A. Discard each air- and water-resistive sheathing board with damage that compromises continuity or impairs performance as an air barrier and is unable to be repaired according to manufacturer's written repair instructions.
  - 1. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Comply with ASTM C 1280, GA-253, and manufacturer's written instructions.
  - 1. Fasten sheathing boards to cold-formed metal framing with specified screws in pattern indicated.
  - 2. Install sheathing boards with a 1/4-inch gap where they abut masonry or similar materials that might retain and transmit moisture to them.
- C. Cut sheathing boards at penetrations, edges, and other obstructions of work to allow for application of air barrier accessory materials. Fit sheathing boards closely against abutting construction.
- D. Install sheathing boards with long dimension perpendicular or parallel to framing. Abut ends and edges of sheathing boards centered over face of framing members. Offset sheathing boards joints by not less than one stud spacing.
  - 1. Apply sheathing boards in pieces sized to provide minimum number of joints and optimum sheathing board arrangement. Arrange joints so that pieces do not span between fewer than three support members.
  - 2. Do not bridge building expansion joints; cut and space edges of sheathing boards to match spacing of structural support elements.
- E. Space fasteners maximum 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of sheathing boards and as required in indicated fire-resistance-rated designs.
  - 1. Apply fasteners so heads are seated flush to board product air barrier membrane surface without breaking or punching through the surface.
    - a. Treat all fasteners with specified fluid-applied flashing used for sealing joints.
    - b. Misplaced fasteners shall be left in place and treated. If fasteners must be removed, patch and treat resulting hole per system manufacturer's written instructions.
  - 2. Securely attach sheathing boards to substrate by fastening as indicated, complying with the following:
    - a. Table 2304.9.1, "Fastening Schedule," in the IBC.
    - b. ICC-ES evaluation report for fastener.
  - 3. Use corrosion resistant sheet metal screw fasteners. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections.
- F. Coordinate wall sheathing boards installation with flashing and air barrier accessory material installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

### 3.4 INSTALLATION OF SITE FLUID-APPLIED AIR BARRIER FLASHING

- A. General: Apply site fluid-applied AB at joints, fasteners, penetrations, openings, and material transitions to achieve a continuous air barrier according to air barrier manufacturer's written instructions. Apply site fluid-applied AB within manufacturer's recommended application temperature ranges.
- B. Apply self-adhered flashing material in full contact with substrate to produce a continuous seal according to air barrier manufacturers written instructions.
  - 1. Vapor-Permeable Air barrier: Total wet film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 16 mils wet film thickness, applied in one or more equal coats by roller, spray, trowel, or knife.
- C. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- D. Do not cover air barrier until it has been inspected and approved by the Authority Having Jurisdiction for compliance with the applicable IBC and IECC. Components and systems subject to inspections include, but are not necessarily limited to, the following:
  - 1. Inspections at framing and rough-in shall be made before application of exterior and interior finishes and shall verify compliance with the code as to air leakage controls.

- E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

### 3.5 INSTALLATION OF AIR BARRIER ACCESSORY MATERIALS

- A. General: Install accessory materials according to air barrier manufacturer's written instructions and AAMA 714. Install AB to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior fenestration systems, door framing, and other openings.
- B. Apply primer according to manufacturer's written installation instructions.
- C. Seal punctures, voids, and seams. Patch with fluid-applied flashing extending 6 inches beyond repaired areas.
- D. Seal wall penetrations according to manufacturer's written installation instructions and recommendations.
- E. Connect and seal exterior wall air barrier continuously to subsequently-installed roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- F. Rough Openings: Apply bead of fluid-applied flashing to inside corners first, followed by application to jambs, header, sill, and adjacent sheathing.
- G. Flashings: Seal top of through-wall flashings to air barrier with fluid-applied flashing.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
  - 1. Inspections: ABs, accessories, and installation are subject to inspection for compliance with requirements and photograph documentation of conditions to be concealed by subsequent Work.
- B. Tests: As determined by Owner's testing agency from among the following tests:
  - 1. Qualitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization or ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
  - 2. Quantitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 783.
- C. Air- and water-resistive sheathing board will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.7 CLEANING AND PROTECTING

- A. Clean spills, stains, and overspray resulting application using cleaning agents recommended by manufacturers of affected construction. Remove masking materials.
- B. Protect air barrier from damage from subsequent work. Protect materials from exposure to UV light for period in excess of that acceptable to air barrier manufacturer; replace overexposed materials and retest.

END OF SECTION

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SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Standing and running trim.
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry.
  - 2. Section 08 14 23 - Plastic-Laminate-Faced Wood Doors.
  - 3. Section 08 71 00 - Door Hardware: masterkey cabinet locks.
  - 4. Section 10 12 00 - Display Cases.
  - 5. Section 12 32 16 - Manufactured Plastic-Laminate-Clad Casework.
  - 6. Section 12 36 61.19 - Quartz Agglomerate Countertops

1.2 SUBMITTALS

- A. General: Submit following items in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Manufacturer's technical literature for factory fabricated items and components.
- C. Shop Drawings
  - 1. Indicate profiles, sections, and views of stock items as well as specially fabricated items for the work, at scale large enough to permit checking for design conformity.
  - 2. Indicate sizes, quantities, markings, materials, wood species, finishes and accessories.
  - 3. Include assembly and installation drawings to show methods of blocking, fastening, bracing, jointing, and connecting to work of other trades.
- D. Samples
  - 1. Two samples of each type and species of plywood, M-3i, 47# particleboard, and finish lumber specified, complete with applied finish.
  - 2. Each type of hardware and fastening device required in the construction of the work specified herein.
- E. Certificate: Submit certification by testing plant stating chemicals and process used, conformance with referenced standards and governing ordinances, and non-bleeding quality of treatment.

1.3 QUALITY ASSURANCE

- A. AWS Quality Standard: Comply with grades of interior architectural woodwork, construction, finishes and other requirements of the "Architectural Woodwork Standards", 2nd Edition, 2014, adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), except as otherwise indicated.
  - 1. Use Premium Grade, except use Economy Grade for millwork in custodian closets and storage rooms. Items not given a specific quality grade shall be Premium Grade.
- B. Mock-up: Construct the mock-up cabinet as designated on the drawings using materials and hardware proposed for the project. The cabinet shall duplicate the typical construction and quality grade specified. Deliver the mock-up cabinet to the project site for approval by Architect. Notify the Architect in writing one week in advance of the mock-up's on-site arrival. Mock-up cabinet shall be made fully acceptable to the Architect through re-manufacture at the millwork shop or through acceptable field corrections prior to commencing construction of other cabinets. Mock-up cabinet shall be properly identified, and, if acceptable to Architect may be installed in the project. Once installed, do not alter or move the mock-up cabinet.
- C. Lumber and Plywood Material Grading: As defined in AWS Section 4 - Sheet Products, and as defined by the rules of the recognized associations of lumber and plywood manufacturers producing the materials specified.

- D. Color Uniformity: Provide plastic laminate for laminate-clad millwork and plastic faced wood doors from the same manufacturer.
- E. Fabrication Standards: Fabricate items in accordance with AWS standards listed below using Premium Grade except at millwork scheduled to be installed in Custodian's Closets and storage rooms, which shall be Economy Grade.
  - 1. Lumber grades: AWS Section 3 - Lumber.
  - 2. Miscellaneous Work: AWS Section 6 - Interior & Exterior Millwork.
  - 3. Painted Millwork: AWS Section 10 - Casework.
  - 4. Countertops: AWS Section 11 - Countertops.
- F. Regulatory Requirements: Conform to applicable code for fire retardant requirements.
- G. Accessibility Standards: Meet Texas Accessibility Standards (TAS) special requirements for the following:
  - 1. Countertop height with or without cabinet below
  - 2. Kneespace clearance to be minimum clearance
  - 3. 12 inch deep shelving, adjustable and fixed
  - 4. Wardrobe cabinets, furnished with rod/shelf adjustable to 48 inches above finished floor, with a maximum 21 inch shelf depth.
  - 5. Sink cabinet clearances
  - 6. Cabinet locks, latches, and other operating mechanisms, except locked bottom drawers at base cabinets.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver woodwork to the project site only when dry and product storage space is available at or in the building so that it can be kept dry and protected from injury.

#### 1.5 PROJECT CONDITIONS

- A. Protection: Protect finish woodwork surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering. Woodwork damaged through neglect of the above requirements shall be repaired or replaced without additional cost to the Owner.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install finish carpentry products only when temperature and humidity conditions have been stabilized and will be maintained.
- B. Maintain temperature and moisture conditions as recommended by woodwork fabricator from date of installation through remainder of construction period.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General:
  - 1. Comply with quality and grading standards contained herein for each material.
  - 2. Sizes noted on drawings or indicated herein for lumber are nominal unless detailed by specific dimensions of actual size.
  - 3. Cabinets: Plywood and M-3i, 47#, particleboard  $\frac{3}{4}$ " thickness unless noted or detailed otherwise.
  - 4. Countertops: Plywood and M-2, 45#, particleboard 1" thickness unless noted or detailed otherwise.
  - 5. Products surfaced four sides, unless noted otherwise.
- B. Softwood Lumber
  - 1. Quality standard: PS 20.
  - 2. Grading Standard: AWS Premium grade.
  - 3. Maximum moisture content: 6% for interior work; 10% for exterior work.
  - 4. Species: Douglas fir.
  - 5. Grain: Plain sliced.
- C. Softwood Plywood
  - 1. Quality standard: PS 1.

2. Grading standard: AWS Premium grade.
3. Core material: C-D Plugged INT-APA.
4. Face quality: A-B INT-APA.
5. Species: Douglas fir.
6. Ply construction: 3 ply - 3/8-inch; 5 ply - 1/2-inch; 7 ply - 3/4-inch.

D. Hardwood Lumber

1. Quality standard: FS MM-L-736C.
2. Grading standard: AWS Custom grade.
3. Maximum moisture content: 6%.
4. Species: Red Oak.
5. Grain: Plain sliced.

E. Hardwood Plywood

1. Quality standard: PS51.
2. Grading standard: AWS Custom grade.
3. Core material: Fir Veneer.
4. Face veneer: Red Oak.
5. Grain: Plain sliced.
6. Ply construction: 3 ply - 3/8-inch; 5 ply - 1/2-inch; 7 ply - 3/4-inch.

## 2.2 ACCESSORIES AND TREATMENT

- A. Contact Adhesive: FS MMM-A-130B, of type recommended by millwork manufacturer to suit application.
- B. Wall Adhesive: Solvent release cartridge type, compatible with substrate, capable of achieving durable bond.
- C. Glass: clear tempered, 1/4-inch thick.
- D. Bolts, Nuts, Washers, Lags, Pins, Nails, and Screws: Size and type to suit application.
- E. Nails: Size and type to suit application, plain finish.
- F. Millwork Reveal: As scheduled; reference Finish Accessory, Furniture and Equipment Schedule.

## 2.3 COUNTERTOPS AND WINDOWSILLS

- A. Quartz Agglomerate Countertops and Windowsills:
  1. Material: Reference SECTION 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS.
  2. Fabrication: Fabricate windowsills and countertops to detail using quartz agglomerate panels as specified in Section 12 36 61.19. Use seam adhesive and color-matched sealant by quartz agglomerate material manufacturer.

## 2.4 TRANSPARENT FINISH

- A. AWS Premium quality. Refer TO SECTION 09 91 00 - PAINTING with stain and sheen to be Custom Color as selected by Architect.

## 2.5 SHOP FABRICATION

- A. Fabricate millwork to AWS Premium standards for flush overlay construction as detailed (or as indicated in AWS Section 6 Millwork if details are not present).
- B. Sanding/Filling
  1. Perform work according to AWS requirements.
  2. Sand work smooth and set exposed nails and screws.
  3. Apply wood filler in exposed nail and screw indentations and leave ready to receive applied finishes.
  4. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.
- C. Prime seal concealed and semi-concealed surfaces. Brush apply only.

- D. Provide cutouts for inserts, outlet boxes, and other fixtures. Verify locations of cutouts from site dimensions. Seal edge surfaces of cutouts.
- E. Before proceeding with millwork required to be fitted to other construction, field-verify applicable measurements and include on shop drawing details.
- F. Fabricate millwork to dimensions, profiles, and details shown.
- G. Route and groove back of flat trim members, kerf backs of other wide flat members except plywood or veneered members.
- H. Assemble millwork in mill in as large of units as practicable to minimize field cutting and fitting.
- I. Miter trim joints, where required, by joining, splining, and gluing to complying with requirements for specified grade.
- J. Band exposed plywood and particleboard edges with hardwood trim, 3/8-inch x width of sheet unless otherwise noted or shown to be trimmed with plastic or aluminum.

## 2.6 FINISH

- A. Sand work smooth and set exposed nails.
- B. Apply wood filler in exposed nail indentations.
- C. On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify location of wood blocking prior to installation of finish carpentry.

### 3.2 INSTALLATION

- A. Installation of Standing and Running Trim and Millwork: Comply with applicable AWS Section installation requirements.
- B. Workmanship: Exposed woodwork shall have a smooth finish, free from machine and tool marks, abrasions, and raised grain on exposed surfaces. Joints shall be tight and formed so as to conceal shrinkage.
- C. Interior Woodwork Installation:
  - 1. Accurately scribe and closely fit face plates, filler strips and trim strips to abutting walls and to irregularities of adjacent surfaces.
  - 2. Set wood finish straight, plumb, and level, in true alignment, and rigidly fastened in place. Nailing and fastening shall be concealed where possible. Set exposed nail heads for puttying.
  - 3. Anchor base and wall cabinets to walls with fully threaded oval head wood screws with finishing washers set at a minimum of 12 inches on center.

END OF SECTION

SECTION 07 11 13

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concealed mastic dampproofing in masonry walls. Refer to schedule at end of section.

B. Related Requirements:

1. Section 04 20 00 - Masonry Units.
2. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
3. Section 07 14 00 - Fluid-applied Waterproofing.
4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers
5. Section 07 65 00 - Flexible Flashing

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Indicate properties of products, performance characteristics, proposed use, and certifications that product meets or exceeds standards.

C. Manufacturer's Instructions: Including application instructions, precautions, material safety, and methods of attachment/embedment into substrate data sheets.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Waterproofing Manual, and manufacturer's instructions, whichever are more stringent.

B. For interior and concealed in all applications, provide product certified by manufacturer to be substantially odor-free within 24 hours of application.

1.4 QUALIFICATIONS

A. Applicator Qualifications: Company experienced in application of dampproofing with 3-years experience on similar sized projects.

1.5 FIELD SAMPLES

A. Provide 4 x 6 foot field sample of mastic dampproofing under provisions of SECTION 01 45 00 - QUALITY CONTROL illustrating application techniques and material thickness.

B. Sample may be incorporated as part of work if approved in writing by Architect.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING PROTECTION.

B. Do not allow products to become frozen.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and surface temperature above 40°F. for 24 hours before application and continuously until mastic dampproofing has cured.

B. Do not allow dampproofed surfaces to be exposed to prolonged sunlight.



## 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate installation in accordance with SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Do not begin work until substrate preparation is complete.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Mastic: ASTM D 1227, Type II, Class 1, semi-mastic asphaltic emulsion reinforced with non-asbestos fibers. Product/manufacturer; one of the following:
  - 920AF Fibered Emulsion Mastic; Karnak
  - Sealmastic; W.R. Meadows, Inc.
  - MasterSeal 615; Master Builders Solutions, a brand of MBCC Group.
- B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

### 2.2 ACCESSORIES

- A. Mastic Dampproofing:
  - 1. Emulsion Based Dampproofing: Non-asbestos fiber reinforced emulsion asphaltic compound, brush or spray consistency, meeting requirements of ASTM D 1227 or FS-4-1781.
  - 2. Reinforcing Mesh; Treated glass fabric, woven design, 20 x 10 mesh.
  - 3. Plastic Cement: Type recommended by manufacturer and compatible with dampproofing product, for trowel consistency.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
- B. Do not apply when surface of ambient temperature is below 40°F., during inclement weather, or if surface is damp, dirty, or dusty.
- C. Verify surfaces are solid and free of cracks, pits, rough or sharp projections.
- D. Verify items which penetrate surface to receive dampproofing are securely anchored.

### 3.2 PREPARATION

- A. Remove rough or sharp projections, loose particles, and foreign matter detrimental to adhesion and application of dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's written instructions.
- C. Apply two coats of plastic cement and one layer of reinforcing mesh (between plastic cement coats) to seal penetrations, small cracks, and at other areas as recommended by manufacturer.
- D. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at control joints.

### 3.3 INSTALLATION

- A. Mastic Dampproofing: For application over concealed masonry and concrete surfaces within walls.
  - 1. Clean surfaces of excess mortar and loose dirt and apply the mastic in two coats by brush or spray. Allow the first coat to dry tacky before applying the second coat.

2. Coverage shall be approximately 35 sq.ft. per gallon per coat. Fill in crevices and grooves and around projecting anchors and joint reinforcement. Make sure that coating is continuous and free from breaks and pinholes.
3. At glass-mat gypsum sheathing, apply dampproofing prior to installation of masonry anchors.

#### 3.4 FIELD QUALITY CONTROL

- A. Tests: Periodically (not less than once per 100 sq.ft. of surface area) check application thickness to verify compliance with specified thickness. Immediately re-apply if found to be deficient.

#### 3.5 PROTECTION

- A. Protect finished installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Protect adjacent surfaces not to receive dampproofing against "overspray" or "over brush".
- C. Protect dampproofing against damage during backfilling with adhered protection course, neatly fitted around projections and penetrations. Do not apply until dampproofing has thoroughly cured.
- D. Protect flashing until placement within wall is complete. Do not allow wind to displace or damage flashing.

#### 3.6 CLEANING

- A. Perform final cleaning under provisions of SECTION 01 74 13 - PROGRESS CLEANING.

#### 3.7 DAMPPROOFING SCHEDULE

- A. Dampproof as follows with mastic:
  1. Over the exterior surfaces of the inside wythe of masonry and concrete backup in below-grade exterior cavity walls to provide an unbroken dampproofing barrier.
  2. Over the inside wythe of masonry and concrete backup in non-conditioned buildings or dumpster walls.
  3. Elsewhere where indicated.

END OF SECTION

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SECTION 07 14 00

FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fluid applied elastomeric waterproofing:
  - 1. Vertical waterproofing below-grade.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete.
  - 2. Section 32 05 19 - Geotextiles for Exterior Improvements.

1.2 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include membrane thickness, accessories, and method of application.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: This work shall be performed by an experienced applicator who has successfully applied the materials and used the methods specified under similar conditions over a period of at least five years.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in the original, sealed containers or unopened packages clearly labeled with the manufacturer's name and the contents.
- B. Store materials in a heated and ventilated area located away from all sources of sparks and open flame. Containers of liquid material shall not be left open at any time in the storage area.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Elastomeric Waterproofing: Provide a one-component, moisture-curing, bitumen-modified polyurethane elastomeric waterproofing membrane, containing no coal tar extenders. Provide formulation appropriate for chosen horizontal or vertical installation with associated trowel, squeegee, roller or spray application. Product/manufacturer; one of the following:
  - MasterSeal HLM 5000; Master Builders Solutions, a brand of MBCC Group.
  - MiraSEAL; Carlisle Coatings & Waterproofing Incorporated (CCW)
- B. Flashing Membrane: Provide 1/16" thick neoprene synthetic rubber sheet.
- C. Adhesive: Provide neoprene adhesive manufactured expressly for use with the synthetic rubber flashing membrane.
- D. Drainage Mat: Reference SECTION 32 05 19 - GEOTEXTILES FOR EXTERIOR IMPROVEMENTS.
- E. Protection Board: Provide a semi-rigid, asphalt saturated board 1/8" thick. Product/manufacturer: Type PC-2 Protection Course; W.R. Meadows.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Remove loose dirt and debris and clean off oil, grease, paint and other foreign contaminants to leave the concrete surface clean and dry. Immediately prior to and during application, remove dirt and dust from the surface with compressed air or a soft broom. Mask with paper and tape the surfaces not designated to receive waterproofing to protect them from accidental application of the waterproofing material.

### 3.2 INSTALLATION

- A. Applying Waterproofing:
  - 1. Select the grade of product that best meets the individual job requirements.
  - 2. Mix the waterproofing compound thoroughly in conformance with the manufacturer's printed instructions.
  - 3. Vertical Application: Apply one coat using a roller, trowel, or squeegee as required to obtain thickness required. Wait for material to film form and become stable between each coat.
  - 4. Install flashing membrane along perimeter walls. Install with adhesive applied to the concrete surface and to the back of the membrane. Press firmly into place without stretching and work out all bubbles, wrinkles and fishmouths. At walls in horizontal application, turn membrane up approximately 3" above the waterproofed surface to form a dam. Lap joints 3" and bond with adhesive.
  - 5. Over flashing membrane, apply a thin coat of neoprene adhesive and allow to dry until tacky before covering with the waterproofing compound. On metal pipes and conduits projecting through the concrete, apply a second coat of waterproofing compound after the first coat has cured. Extend the waterproofing into the floor drain flashing rings.
  - 6. For at least 24 hours after completion of the waterproofing, keep the area clear of all traffic. After testing for leaks, cover the waterproofing with protection board laid with close butt joints and cut to fit around projections and at offsets.

### 3.3 FIELD QUALITY CONTROL

- A. Testing: Floor areas protected with elastomeric waterproofing shall be flood tested for leaks prior to installing the protection board. Plug the floor drains and flood the areas with water to a depth of 2" or more. Allow the water to stand for 24 hours before draining off. Repair all leaks.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Clear water repellent coating applied to exterior vertical and sloping concrete and masonry (brick and cast stone) surfaces.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-in-place Concrete: cleaning of concrete surfaces.
  - 2. Section 04 20 00 - Masonry Units: cleaning of masonry surfaces.
  - 3. Section 09 91 00 - Painting: painting of exterior concrete masonry units.

1.2 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions.
- B. Samples: 12" x 24" sample of substrate with half of sample having been treated with coating and the other half bare.
- C. Manufacturer's Instructions: Installation instructions, including application rates, methods and techniques.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Work shall be performed by an experienced applicator who has not less than five years experience and has successfully applied this material under similar conditions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in the original, sealed containers clearly labeled with the manufacturer's name and the contents. Store material in a well-ventilated area.

1.5 FIELD SAMPLE

- A. Apply coating to approximately a 100 sq. ft. area of substrate material for Architect's approval.
- B. Verify that substrate has received a sufficient amount of coating to perform as intended and that product is not staining or discoloring surface.
- C. When approved, field sample may remain as part of the work.

1.6 PROJECT CONDITIONS

- A. Do not apply coating when ambient or substrate temperatures are lower than 40°F. or higher than 100°F.
- B. Do not apply during inclement weather or when forecasted conditions will not permit work in accordance with manufacturer's printed instructions.
- C. Do not apply during windy conditions that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.
- D. Provide mechanical ventilation during and after application to dissipate fumes if natural ventilation is insufficient.

## 1.7 WARRANTY

- A. Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within 5 years from date of substantial completion.

## 1.8 EXTRA MATERIALS

- A. Furnish under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES, AND MAINTENANCE MATERIALS.
- B. Provide two gallons of coating.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Provide a colorless water and stain repellent coating for concrete and masonry. Coating shall be clear, liquid, penetrating, solvent based, non-yellowing, non-staining, breathable acrylic solution, have a minimum solids of 5% as determined by ASTM D 2369 testing, and meeting requirement of FF-SS-110C. Product/manufacture; one of the following:
  - Prime-A-Pell 200; Chemprobe Coating Systems, A Division of Tnemec Co., Inc.
  - Euco-Guard 200; Euclid Chemical Co.
  - Klere-Seal 908-SX; Pecora Corp.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
- B. Verify that surfaces are clean, dry, sound, properly covered, dust free, free of efflorescence, oil or other matter detrimental to coating application.
- C. Verify that joint sealant work is complete and sealant has properly cured.
- D. Verify that cracks in concrete larger than 1/64" in width have been filled with patching compound acceptable to coating manufacturer.

### 3.2 PREPARATION

- A. Examine surfaces to be treated for loose dirt and debris, stains, chemical films, oil, grease, paint and other foreign contaminants. Surfaces shall be clean and dry prior to application. Immediately prior to and during application, remove any dust and dirt from surfaces.
- B. Allow surfaces to dry sufficiently after washing in accordance with manufacturer's directions.
- C. Protect adjacent surfaces from overspray or drift.
- D. Protect landscaping, adjacent property, and vehicles.
- E. Comply with manufacturer's written instructions.

### 3.3 INSTALLATION

- A. Apply using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

- B. Apply the coating to dry surfaces using a standard metal tank sprayer or painting apparatus such that the treatment totally wets the surface. Apply evenly, being careful to avoid excessive run down. Avoid misting of the spray as the treatment is applied. Protect shrubs and painted surfaces during application. Allow coating to cure.
- C. Do not dilute or alter material as packaged.

### 3.4 CLEANING

- A. Take care to avoid spraying coating on adjacent materials. Any such soiling shall be carefully and completely cleaned using a suitable solvent.
- B. After application on glazed brick and mortar, wipe down brick only to remove any extra coating residue retained on the brick.

END OF SECTION



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SECTION 07 21 00

BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Thermal, acoustical, and fire safing building insulations.
- B. Related Sections:
  - 1. Section 03 52 16 - Insulating Concrete Decks: roof insulation.
  - 2. Section 04 20 00 - Masonry Units.
  - 3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
  - 4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers
  - 5. Section 07 65 00 - Flexible Flashing
  - 6. Section 07 84 00 - Firestopping.

1.2 SUBMITTALS

- A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Including performance specifications, composition and applicable standards.
- C. Samples: Submit 12" x 12" size samples of each type insulation proposed for use.
- D. Manufacturer's Instructions: Written installation instructions, including attachment recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: (See Articles below for specific products)
  - CertainTeed Architectural
  - Dow Chemical Company
  - Johns Manville, A Berkshire Hathaway Co., Denver, CO
  - Knauf Insulation
  - Owens Corning, Toledo, OH
  - Rockwool
  - Thermafiber, Inc. (Owens Corning)
  - U.S. Gypsum Co.

2.2 BATT THERMAL INSULATION

- A. Glass fiber composition, unfaced, minimum one lb./c.f. density, meeting following standards:
  - 1. ASTM E 84: FHC 25/50 maximum.
  - 2. ASTM C 518: R value of 3.2 per inch of thickness.
  - 3. ASTM C 665: Type I and Type III, Class A.
- B. Following products are acceptable:
  - 1. Unfaced Thermal Batts by Owens Corning Fiberglas Corp.
  - 2. Unfaced Building Insulation by CertainTeed Architectural
  - 3. Unfaced Building Insulation by Johns Manville Corp.
  - 4. Unfaced EcoBatt Insulation by Knauf Insulation

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
  - 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Following products are acceptable:
  1. TempControl Mineral Wool Batts; Johns Manville Corp.
  2. Thermafiber Ultrabatt Mineral Wool Insulation; Owens Corning
  3. Comfortbatt; Rockwool

## 2.4 SEMI-RIGID INSULATION

- A. Continuous Insulation Basis of Design: Provide Thermafiber RainBarrier 45 Insulation as manufactured by Thermafiber, Inc., Wabash, IN (phone: 888-834-2371; web: [www.thermafiber.com](http://www.thermafiber.com) (an Owens Corning company))
  1. Acceptable Products/Manufacturers:
    - JM CladStone 45 Water & Fire Block; Johns Manville
    - Cavityrock; Rockwool
    - Thermafiber RainBarrier 45; Owens Corning (Thermafiber Inc.)
  2. Description: Non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000° F, meets ASTM C 612, IVA.
  3. Thickness: As noted on contract drawings.
  4. Paint flat black behind joints at open joint panel assemblies.
  5. Type:
    - a. R-value of min. 4.2 per inch.
    - b. Facing: Unfaced.
    - c. Density: 4.5 pcf.
    - d. Surface Burning Characteristics: Unfaced-Flame Spread 0 and Smoke Developed 0
    - e. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C 1104.
    - f. Non-corrosive, ASTM C 665.
    - g. Recycled Content for Standard Mineral Wool Products.....70%

## 2.5 BATT ACOUSTICAL INSULATION

- A. Unfaced glass fiber composition, 3½" thick, minimum one lb./c.f. density, meeting following standards:
  1. ASTM E 84: FHC 25/50 maximum.
  2. ASTM C 518: R value of 3.2 per inch of thickness.
  3. ASTM C 665: Type I, Class A.
- B. Following products are acceptable
  1. Sound Control Batts by CertainTeed Architectural
  2. EcoTouch Sonobatts by Owens Corning Insulating Systems, LLC
  3. Unfaced Building Insulation by Johns Manville Corp.
  4. EcoBatt Insulation by Knauf Insulation

## 2.6 FIRE SAFING INSULATION

- A. Mineral fiber composition, 4" thick, 4.0 pcf density, meeting following standards
  1. ASTM E 84: FHC 15/10 maximum.
  2. ASTM C 665: Type I, Class A
  3. ASTM E 119: Testing Procedures.
  4. FS HH-I-558B: Class 1 and 2.
- B. Following products are acceptable
  1. Thermafiber Safing Insulation by Owens Corning.
  2. Mineral Wool Safing Insulation by Johns Manville.

## 2.7 ACCESSORIES

- A. Joint Tape: Pressure sensitive type, recommended by insulation manufacturer.
- B. Insulation Adhesive: Type recommended by insulation manufacturer.
- C. Stick Clips
  1. Galvanized sheet metal with impaling pins and retainer washers.

2. Size and type to suit application and insulation thickness.
  3. Approved by manufacturer of insulation for intended use.
- D. Stick Clip Adhesive
1. High strength, resilient adhesive, having drying time of 0 to 30 minutes (rapid initial set), and 24 hours final set.
  2. Compatible with insulation adhesive, insulation and substrate.
  3. Non-corrosive to galvanized steel.
- E. Supportive Wire Mesh: Hexagonal design, woven mesh "chicken wire" style.
- F. Tie wire: Minimum 18 ga. annealed wire.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive insulation for conditions that will adversely affect the execution and quality of the work. Do not start this work until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. General: Fit insulation tight within stud spaces, above soffits, behind fascias, and tight to and behind mechanical and electric services within plane of insulation, leaving no gaps or voids. Butt insulation tightly. Cut and fit tightly around items penetrating insulation. Stagger and butt joints. Fit courses of insulation between masonry wall ties and other obstructions within cavity wall system, with edges butted tightly in both directions and with faces flush. Press units firmly against inside substrates.
- B. Install in conformance with the manufacturer's recommendations. Cut material to fit closely around obstructions and projections.
1. Walls: Secure insulation by mechanical means to hold it in place without sagging or slumping. Install insulation with edges and joints butted tight to leave no gaps.
  2. Soffits: Insulation shall be laid between wire hangers on back of cement plaster and over cross runners. Sides and ends of adjacent batts shall be tightly butted together.
  3. Acoustical Insulation:
    - a. Install acoustical insulation between the studs in those gypsum drywall partitions so detailed and noted on the drawings. Staple blankets to the gypsum board or otherwise fasten in place as recommended by the manufacturer of the blankets. Fill all voids.
    - b. Where indicated at suspended gypsum board ceilings, lay sound attenuation blankets between wire hangers on back of gypsum board and over cross runners. Do not install on top of or within 3" of light fixtures.
- C. Applying Semi-Rigid Insulation: Install board insulation between the wythes in exterior masonry walls.
1. In masonry walls place boards over the fluid-applied membrane air barrier on the face of the backup masonry before the face brick wythe is laid.
  2. Securely fasten the board to the backup with mastic and suitable mechanical anchors to hold it firmly in place.
  3. In framed construction, apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
  4. Cut the material to fit snugly around obstructions and projections. Joints shall be tight.
  5. Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- D. Safing Insulation: Compress and install insulation on wire hangers or clips in spaces between floor slabs and curtain walls. Also, in openings in floor slabs to seal around telephone cables, piping, ducts and other utilities per SECTION 07 84 00 - FIRESTOPPING.

### 3.3 SCHEDULES

- A. Provide R values for thermal insulation as indicated on the drawings.

- B. Provide acoustical insulation in thickness and locations as follows:
1. Walls: 3½" (or as shown on drawings)
  2. Above Ceilings: 3½" (or as shown on drawings)

END OF SECTION

SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Vapor retarder placed on soil surface.
- B. Related Sections:
  - 1. Section 03 11 00 - Concrete Forming and Accessories: Masonite topping sheet.
  - 2. Section 03 30 00 - Cast-in-Place Concrete.
  - 3. Section 07 62 00 - Sheet Metal Flashing and Trim: Vapor retarder at roof expansion joints.
  - 4. Section 31 31 00 - Soil Treatment: Temporary polyethylene sheeting over treated soil.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Provide product data for each type of product.
  - 2. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
  - 3. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vapor Retarder: Product/manufacturer; one of the following:
  - Ecoshield-E; Epro Services
  - Stego Wrap (15 mil) Vapor Retarder; Stego Industries, LLC
  - Perminator (15 mil); W.R. Meadows
- 1. Vapor Retarder membrane shall have the following qualities:
  - a. Permeance of less than 0.01 Perms [grains/(ft<sup>2</sup>\*hr\*inHg)] as tested after mandatory conditioning tests ASTM E 154 (sections 8, 11, 12, 13) per ASTM F 1249 or ASTM E 96.
  - b. ASTM E 1745 Class A.
  - c. Minimum thickness 15 mils.
- 2. Accessories:
  - a. Seam Tape: High-density polyethylene tape with pressure sensitive adhesive. Minimum width 3.75 inches.
  - b. Pipe Boots (Penetrations of Vapor Retarder): Construct pipe boots from vapor retarder material and pressure sensitive tape per manufacturer's instructions.
  - c. Perimeter/edge seal: Provide the following as manufactured by Stego Industries LLC, (887) 464-7834 [www.stegoindustries.com](http://www.stegoindustries.com).
    - 1) Stego Crete Claw
    - 2) Stego Term Bar.
    - 3) StegoTack Double-Sided Tape.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove soil treatment protective vapor retarder before placement of permanent vapor retarder.
- B. Ensure that subsoil is approved by Architect and/or geotechnical engineer.

### 3.2 INSTALLATION

- A. Install vapor retarder in accordance with manufacturer's instructions and ASTM E 1643.
- B. Unroll vapor retarder with the longest dimension parallel with the direction of the concrete pour.
- C. Extend vapor retarder to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor retarder. At the point of termination, seal vapor retarder to the slab itself using perimeter/edge seal, such as Stego Crete Claw or termination bar and tape per manufacturer's instructions.
  - 1. Continue vapor retarder down the interior face of the perimeter grade beam, across the bottom of the grade beam, and up the outside face to within 6" of finish grade.
- D. Overlap joints a minimum of 6" and seal with manufacturer's seam tape.
- E. Seal all penetrations (including pipes) with manufacturer's pipe boot.
- F. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor retarder.
- G. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6" and taping all four sides with tape.

END OF SECTION

SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Vapor-permeable, fluid-applied air barriers, which also function as water-resistive barriers.
- B. Related Requirements:
  - 1. Section 01 45 00 - Quality Control: for general mockup requirements.
  - 2. Section 04 20 00 - Masonry Units; concrete unit masonry treatment.
  - 3. Section 06 16 56 - Air and Water-Resistive Sheathing Board System: for vapor-permeable air- and water-resistive wall sheathing and associated site-fluid-applied air barrier flashing.

1.2 DEFINITIONS

- A. Air-Barrier Material (AB): A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- D. Water-Resistive Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, and installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
  - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
  - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 3. Include details of interfaces with other materials that form part of air barrier.
  - 4. Consult air barrier manufacturer for additional installation guidelines and illustrations to assist with meeting shop drawing requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
  - 1. Certification shall include statement that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.
  - 2. Certification shall include statement that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.



- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
  - 1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
    - b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
    - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.
- B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
  - 1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
  - 2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
  - 3. Water Penetration Testing: Mockups will be tested for water penetration according to ASTM E 1105.
  - 4. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D 4541 (modified).
    - a. Use a type II pull tester, except that the membrane shall be cut through to separate the material attached to the disc from the surrounding material.
    - b. Perform test after curing period recommended by the material manufacturer.
    - c. Record mode of failure and area where the material failed in accordance with ASTM D4541.
    - d. The inspection report shall indicate whether the specified adhesion requirement has been met.
  - 5. Compatibility Determinations: Mockups will be inspected for visual signs of decay, chemical attack, or degradation of any kind. Suspect instances shall be reported to the corresponding manufacturer who shall provide a letter that approves moving forward with the project or rejects the use of the product or rejects the method or circumstances of installation with an appropriate explanation of the position taken.
  - 6. Notify Architect seven days in advance of the dates and times when mockups will be tested.
  - 7. Perform the air leakage test and water penetration test of mockups prior to installation of cladding and trim but after installation of all fasteners for cladding and trim, and after installation of other penetrating elements.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.
- C. Deliver materials to Project site in original packages with seals unbroken, labeled with material Manufacturer's name, product, date of manufacture, and directions for storage.
- D. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material manufacturer.
- E. Handle materials in accordance with material manufacturer's recommendations.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
  - 1. Protect substrates from environmental conditions that affect air-barrier performance.
  - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
- B. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.
- C. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.
- D. Ultra-violet Exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

## 1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which air barrier manufacturer agrees to furnish and install air barrier material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.
  - 1. Manufacturer's Warranty Period: Five (5) years from Date of Substantial Completion.
- B. Installer's Warranty: Provide installer's installation warranty, including all accessories and materials of the air barrier assembly, against failures including loss of airtight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.
  - 1. Installer's Warranty Period: Two (2) years from Date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
  - 1. If the materials in this section are adjacent to the materials specified in Section 06 16 56 Air- and Water-Resistive Sheathing Board System, all materials in this section shall be compatible with the materials and products specified in that section and shall be approved by the air- and water-resistive sheathing board system manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

### 2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Prosoco, Inc.; R-Guard Cat 5 (at medium-build thickness) or a comparable silyl-terminated polyether (STPE) product by one of the following:
    - Tremco, Inc.
    - 3M Industrial Adhesives and Tapes Division.
    - DuPont Safety & Construction.
    - GE Construction Sealants; Momentive Performance Materials Inc.
    - Hohmann & Barnard, Inc.

W.R. Meadows, Inc.

2. Physical and Performance Properties:
  - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
  - b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
  - c. Ultimate Elongation: Minimum 250 percent; ASTM D 412, Die C.
  - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
  - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
  - f. UV Resistance: Can be exposed to sunlight for 120 days according to manufacturer's written instructions.
  - g. Fastener Sealability: No water infiltration when tested in accordance with ASTM D 1970.

## 2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.
    - c. Pecora Corporation.
    - d. Prosoco, Inc.
    - e. Tremco Incorporated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
  3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
  4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

### 3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
  - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
  - 1. Transition Strip: Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

### 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
  - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

3. Where multiple prime coats are needed to achieve required bond or thickness, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
  1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 17 mils, applied in two equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
    - a. Second coat shall be back rolled in accordance with manufacturer's written instructions.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  2. Air-barrier dry film thickness.
  3. Continuous structural support of air-barrier system has been provided.
  4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  5. Site conditions for application temperature and dryness of substrates have been maintained.
  6. Maximum exposure time of materials to UV deterioration has not been exceeded.
  7. Surfaces have been primed, if applicable.
  8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  9. Termination mastic has been applied on cut edges.
  10. Strips and transition strips have been firmly adhered to substrate.
  11. Compatible materials have been used.
  12. Transitions at changes in direction and structural support at gaps have been provided.
  13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  14. All penetrations have been sealed.
- C. Tests: As determined by testing agency from among the following tests:
  1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
  2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
  3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
  1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
  2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
  2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

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SECTION 07 41 20

PREFINISHED METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Prefinished metal roof panels and soffit panels, including related insulation, underlayments, flashing, trim and accessories.
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry.
  - 2. Section 07 62 00 - Sheet Metal Flashing and Trim.
  - 3. Section 07 72 13 - Manufactured Roof Curbs and Portals.
  - 4. Section 07 92 00 - Joint Sealants.

1.2 SYSTEM REQUIREMENTS

- A. Performance Requirements
  - 1. Uplift resistance: UL Class 90 wind uplift resistance.
  - 2. Design and install system to accommodate thermal expansion, thermal contraction and building movement.

1.3 SUBMITTALS

- A. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Drawings shall indicate type of roof panels, gage of metal, finish and shape and size of flashing and accessories.
- C. Product Data: Submit manufacturer's technical literature indicating properties of materials, finishes and performance capabilities.
- D. Samples
  - 1. Submit 2' x 4' section of roof and soffit panel system(s), complete with flashings and attachment devices.
  - 2. Upon selection of colors by Architect, submit 12" x 12" finish samples representing color and finish.
  - 3. Submit 6" x 6" sample of self-adhering sheet underlayment.
- E. Color Charts: Submit samples of manufacturer's full range of standard colors. Submit actual color chips, not photo reproductions.
- F. Qualification Data
  - 1. Submit installer qualifications verifying years of experience; include list of completed projects having similar scope of work identified by name, location, date, reference name and phone number.
  - 2. Submit letter certifying manufacturer's approval for installation of system.
  - 3. On-site or field manufactured panels are not acceptable, unless approved in writing. Field curving of pre-manufactured panels is acceptable. If on site roll-forming is approved, submit documentation on roll-forming equipment which will be used to roll-form roofing panels on site. Provide copy of UL certificate, including certification report identifying Make and Model No., Serial No. of roll-forming machine, panel specification and expiration date of certificate.
- G. Manufacturer's Instructions: Submit written installation instructions indicating method and sequence of installation. Provide for roofing system and self-adhering sheet underlayment.
- H. Warranty: Submit signed and dated copies of warranties.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: This work shall be performed by an experienced applicator who has successfully installed the materials under similar conditions over a period of at least 10 years.
- B. Cover self-adhering sheet underlayment within 14 days of underlayment installation.

PREFINISHED METAL ROOF PANELS



## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver preformed metal roof panels and trim items to the project site with no dents, scratches, or abraded areas. Deliver in manufacturer's standard bundles, securely bound and store at the project site raised above slab or ground level on pallets.

## 1.6 WARRANTY

- A. Submit manufacturer's standard 20-year warranty against fading or visible (noticeable) chalking, checking, crazing or peeling of the exterior finish when exposed to natural sunlight for a period of 20 years.
- B. Submit manufacturer's 20-year "No-Dollar-Limit" Complete System panel and trim weathertightness warranty.
- C. Submit applicator's 2-year weathertightness warranty.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Roof Panels: Basis of Design shall be Double Lock Zee-Lock Panels as manufactured by Berridge. Metal panels shall be zinc coated steel complying with ASTM A 653, and ASTM A792-AZ55 Galvalume®, Grade A; with ASTM A 653 G90 hot-dip coating, 24 gage minimum thickness, with striations, for roof panels. Seam spacing shall be 16" o.c. with 2" high standing rolled seams and all panels having the same spacing. Panels shall be single pieces with no joints. Provide specified panel or approved equivalent product of one of the following:
  - Peterson Aluminum Corp.
  - MBCI
  - Merchant & Evans, Inc.
- B. Finish: Metal roof panels, and all exposed trim items, shall receive fluorocarbon polymeric coating containing 70% PVDF Hylar 5000 or Kynar 500 finish. Color shall be as selected by Architect from manufacturer's complete color line.
- C. Flashing and all trim items which are contiguous to roof panels shall be of the same metal and finish as roof panels.
- D. Fasteners: Provide manufacturer's standard zinc coated self-tapping screws meeting UL 90 requirements.
- E. Isocyanurate Insulation: Reinforced isocyanurate foam core faced both sides with non-asphaltic glass fibers chemically bonded in the manufacturing process. Insulation shall meet the requirements of Factory Mutual Class 1 Roofs. Insulation shall have a minimum of 2 layers with a total thickness, using R-5.0 per inch per NRCA, to meet the R-Value as shown on the Building Assembly Types Sheet on the drawings.
- F. Self-adhering Sheet Underlayment (High Temperature): 30 to 40 mils thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: Stable after testing at 240 degrees F; ASTM D 1970.
  - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
  - 3. Products: Subject to compliance with requirements, provide one of the following:
    - Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
    - Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
    - Henry Company; Blueskin PE200 HT.
    - Metal-Fab Manufacturing, LLC; MetShield.
- G. Mechanical Fasteners and Bearing Plates: Provide U.L. listed (standard) clip designed to allow panels to expand and contract. Steel deck fasteners shall be UL listed and shall be approved by roofing manufacturer for compliance with UL-90 uplift requirements.
- H. Sealants and Gaskets: Manufacturer's standard type suitable for use with installation of metal roofing; non-staining; skinning, non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior applications; colors to match exposed metal.

- I. Internal and External Corners: Same materials, gage and finish as panels; profile to suit system; brake formed to required angles. Mitered internal corners, back braced with sheet stock, to maintain continuity of profile.
- J. Expansion Joints: Same material and where exposed, finish as panels, manufacturer's standard type, of profile to suit system. Exposed fasteners same finish as panels.
- K. Trim, Closure Pieces, Cap, Fascias, Infills, Flashings and Accessories: Same material, gage and where exposed, of same finish as metal panels, brake formed to required profiles.
- L. Touch-Up Paint: As recommended by manufacturer.

## 2.2 FABRICATION

- A. Comply with dimensions, profile, gages and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
- B. Fabricate components of the system at the factory, ready for field assembly.
- C. Fabrication of component profiles on site not permitted.
- D. Apply finish coatings prior to roll forming.
- E. Fabricate continuous panels only. No field joints allowed.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine supporting members and areas to receive prefinished metal roof panels, flashing and trim items for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. General: Install prefinished metal roof panels and related items in strict compliance with manufacturer's recommendations.
- B. Install insulation over metal deck per UL-90. End joints shall occur over solid supports. Stagger end joints of insulation in adjacent rows.
  - 1. Mechanically fasten first layer to the roof deck.
  - 2. Apply second layer over first layer in broken joint pattern so that each layer breaks joints both ways with the preceding layer.
  - 3. Apply insulation with long joints continuous and short joints staggered.
  - 4. Bring insulation panels into moderate contact with each other and cope to fit neatly around projections.
  - 5. Joints parallel to ribs on steel deck installation shall be located over solid bearing.
  - 6. Mechanically fasten first layer to the roof deck throughout. Spacing and number of fasteners shall meet current building code requirements and per UL-90. Adhere second layer of insulation to the first layer.
  - 7. Do not install more insulation at one time than the amount which can be covered with roofing the same day.
  - 8. At the end of each day's work and after any other work stoppage, apply temporary water cutoffs in accordance with metal roof manufacturer's approval.
- C. Self-adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply over insulation at entire roof area, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Do not install underlayment perpendicular to roof slope except at locations specifically required for watertightness.
  - 1. Cover underlayment within 14 days. If underlayment cannot be covered within that time period, install an additional layer of underlayment as described above immediately prior to roof installation.
  - 2. Install underlayment in accordance with underlayment manufacturer's written instructions.

- D. Metal roofing installation shall be installed so that entire metal roof system meets UL Windstorm Resistance Classification 90 and meets 1-hour fire-resistance requirements as indicated on the drawings.
- E. Continuous full length pans shall be fabricated by factory roll forming in power equipment capable of producing metal roofing pans to the required lengths. End laps are not allowed.
- F. Anchor components parts of the prefinished roof panels securely in place, providing for necessary thermal and structural movement.
- G. Install and securely anchor metal flashing, trim and related items to provide a weathertight enclosure.
- H. Install trim, closures, caps and accessories as indicated or required for complete weathertight installation.
- I. Provide a concealed fasteners installation system with no fasteners exposed on the exterior face of the work.
- J. Seal prefinished roof panels as required for weathertightness.
- K. Tolerances:
  - 1. Maximum Offset from True Alignment Between Adjacent Members Butting or in line: 1/16".
  - 2. Maximum Variation from Plane or Location Indicated on Drawings: 1/8".

### 3.3 TOUCH-UP AND CLEAN

- A. Touch-up:
  - 1. Defective materials shall be replaced with new materials.
  - 2. Field touch-up of scratches or defaced finish will be permitted only if approved by Architect.
- B. Cleaning: Clean exposed surfaces; leave free of soil and imperfections.

END OF SECTION

SECTION 07 42 13

PREFINISHED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Preformed metal wall and soffit panels, including related flashing and trim installed on the building.
- B. Related Sections:
  - 1. Section 05 40 00 - Cold-formed Metal Framing; attachment of wall panels
  - 2. Section 09 21 16 - Gypsum Board Assemblies; sheathing

1.2 SYSTEM DESCRIPTION

- A. Coating Performance:
  - 1. Weathering: ASTM G153, no checking, blistering, or adhesion loss after 5000 hours.
  - 2. Chalking: ASTM D4214, maximum #8 rating after 2000 hours.
  - 3. Fading: ASTM D2244, maximum color change of 5 NBS units after 5000 hours.
  - 4. Flexibility: ASTM D522, no coating rupture when subjected to a 180-degree bend around a 1/8-inch mandrel.
  - 5. Abrasion Resistance: ASTM D968, withstands a minimum of 65 liters of falling sand before appearance of base metal.

1.3 SUBMITTALS

- A. Submit the following according to Section 01 33 00 - *Submittals*:
  - 1. Shop Drawings: Show type and profile of wall panels, gage of metal, finish, and shape and size of flashing and accessories.
  - 2. Product Data: Manufacturer's complete product information indicating properties of materials, finishes and performance capabilities.
  - 3. Installation Instructions: Written installation instructions indicating method and sequence of installation of metal wall panel system.
  - 4. Samples
    - a. Two full width x 24 inch long sections of wall and soffit panels, complete with flashings and attachment devices.
    - b. Upon selection of panel colors by Architect, submit two 12x12 inch finish and color samples.
  - 5. Color Charts: Include Manufacturer's full range of standard colors. Submit actual color chips, not photo reproductions.
  - 6. Installer's Qualification Data:
    - a. Years of experience.
    - b. List of completed projects having similar scope of work. Identify projects by name, location, date, and Contact Person's name and phone number.
    - c. Certification indicating Installer is trained and currently approved by Metal Panel Manufacturer for the wall system to be installed.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A company with at least 10 years experience successfully installing Pre-finished metal wall and soffit panels of similar size and conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefinished metal panels, trim, and accessory items to the Project Site securely bound in Manufacturer's standard bundles.
- B. Protect panels from damage and discoloration. Handle panel bundles with non-marring slings only. Do not bend panels.
- C. Store panels above ground with one end elevated for drainage. Protect from standing water and condensation between adjacent surfaces. Ensure proper ventilation.

- D. If panels become wet, immediately separate sheets, wipe dry with a clean cloth, and allow to air dry.

## 1.6 WARRANTY

- A. Manufacturer's standard 20-year warranty against fading or visible chalking, checking, crazing or peeling of the exterior finish.
- B. Installer's 2-year warranty of materials and workmanship for watertightness of entire metal wall and soffit panel system.
1. Make repairs during warranty period resulting from improper workmanship or defective materials, without additional cost to Owner.
  2. Area and type of wall and soffit, Manufacturer's specification numbers, total lengths of flashing guaranteed, and all other pertinent facts shall be correctly and completely stated in warranty before these documents will be acceptable to Owner.
- C. If, during warranty period, Manufacturer or his approved Installer fails to perform repairs within 72 hours of notification, emergency repairs performed by Owner shall not void warranty.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Prefinished Metal Wall Panels Basis of Design:
1. Flush Panel manufactured by Berridge FW-12, 12 inches wide, 24 gage, with concealed attachment or approved equivalent product of one or the following:  
Peterson Aluminum Corp.  
MBCI  
Merchant & Evans, Inc.
  2. Steel Sheets: ASTM A 653, Grade A, minimum yield strength 33,000 psi.
  3. Base Metal Coating: ASTM A 924, G-90 hot-dip galvanized.
- B. Prefinished Metal Soffit Panels Basis of Design:
1. Flush Panel manufactured by Berridge FW-12, 12 inches wide, 24 gage, with concealed attachment or approved equivalent product of one or the following:  
Peterson Aluminum Corp.  
MBCI  
Merchant & Evans, Inc.
  2. Steel Sheets: ASTM A 653, Grade A, minimum yield strength 33,000 psi.
  3. Base Metal Coating: ASTM A 924, G-90 hot-dip galvanized.
- C. Factory-Applied Coil-Coat Finish: Metal wall and soffit panels and all exposed trim items
1. Exterior Face:
    - a. Primer: 0.2 mil baked-on epoxy
    - b. Fluorocarbon polymeric coating containing 70% Kynar 500 or Hylar 5000, minimum dry film thickness of 0.8 mil.
    - c. Color "A": Signature 300 Metallic – Charcoal Gray
    - d. Color "B": Signature 200 – Silver Metallic
  2. Interior Face: Manufacturer's standard epoxy primer and top coat, minimum total thickness of 0.50 mils.
- D. Flashing, gutters, downspouts, and all trim items contiguous to wall panels shall be of the same metal and finish as wall panels.
- E. Fasteners: Screws holding anchor clips to the structure shall be stainless steel cadmium plated self-tapping screws into predrilled holes.
1. Exposed fasteners shall match the finish of the panel system and shall be aluminum or stainless steel with separate washers with hot-bonded neoprene faces; pop rivets are not acceptable.
- F. Building Paper: ASTM D 226, No. 30 asphalt saturated organic felt.
- G. Sealant:
1. Concealed Sealant: Non-curing, non-skinning butyl, polyisobutylene or polybutane tape of sufficient thickness to make full contact with both surfaces.
  2. Exposed Sealant: Curing type, manufacturer's standard. Color shall be as selected by Architect.

## 2.2 FABRICATION

- A. Comply with dimensions, profile, gages, and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
- B. Fabricate full length wall panels by roll forming in power equipment capable of producing metal wall pans in continuous one-piece lengths from base to soffit. End laps will not be accepted.
- C. Fabricate flashings and accessories in longest practical lengths.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine supporting members and areas to receive preformed metal wall panels, flashing, and trim items for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.
- B. Field-verify dimensions prior to fabrication. Ensure that supporting members and penetrations are complete and accurately located and secured.

### 3.2 INSTALLATION

- A. General: Install preformed metal wall and soffit panels and related items according to Manufacturer's written instructions.
- B. Install panels true and plumb with joints vertical. Cutting and fitting shall be neat, square, and true. Torch cutting is prohibited.
- C. Securely anchor component parts of the preformed wall and soffit panels securely in place, while allowing necessary thermal and structural movement.
- D. Installed metal panels, flashing, trim and related items shall provide an air and weather-tight enclosure impervious to moisture.
- E. Provide concealed fasteners installation system with no fasteners exposed on the exterior face of the metal panels.
- F. When used in windscreen or fence location, panels must be fastened (stitched) through side joints.

### 3.3 TOUCH-UP AND CLEAN

- A. Touch-up:
  - 1. Defective materials shall be replaced with new materials.
  - 2. Field touch-up of scratches or defaced finish will be permitted only if approved by Architect.
- B. Cleaning: Clean exposed surfaces; leave free of soil and imperfections.

END OF SECTION

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SECTION 07 55 52

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Complete modified bitumen roofing system including:
    - a. Roofing membrane
    - b. Curbs
    - c. Expansion joints
    - d. Flashing and reglets
    - e. White granule surfaced cap sheet.
- B. Related Sections:
  - 1. Section 01 31 19 - Project Meetings
  - 2. Section 03 52 16 - Insulating Concrete Decks: roof insulation
  - 3. Section 05 31 00 - Steel Decking
  - 4. Section 06 10 00 - Rough Carpentry: wood nailers, blocking and curbs
  - 5. Section 07 62 00 - Sheet Metal Flashing and Trim
  - 6. Section 07 72 13 - Manufactured Roof Curbs and Portals
  - 7. Section 07 72 33 - Roof Hatches.

1.2 SYSTEM DESCRIPTION

- A. Fire Resistance:
  - 1. Roof covering shall have UL 790 Class A rating.
  - 2. Complete roof system shall be listed as Class 1-A construction according to FM 1-29
- B. Wind Up-lift Requirements: Provide a roofing system identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressures calculated according to ASCE-7 Wind uplift pressures for the Project area, with a 3-second gust of 110 mph.

1.3 SUBMITTALS

- A. Submit the following according to Section 01 33 00 - *Submittals*:
  - 1. Product Data: Manufacturer's printed specifications and instructions for installation of roofing system. Include applicable temperature range, procedures and materials for terminations, flashing, and expansion joints.
  - 2. Shop Drawings: Include the following:
    - a. Roof configuration
    - b. Design of tapered insulation system showing layout, slope and thickness of entire system.
    - c. Sheet layout
    - d. Location of field splices
    - e. Type of splices
    - f. Mechanical equipment flashing
    - g. Expansion joints
    - h. Termination details
    - i. Penetration details
    - j. Parapet wall details
    - k. Roof slopes
    - l. Crickets
  - 3. Samples:
    - a. 12x12 inch sample of each membrane material
    - b. Each type of fastener
  - 4. Certificates:
    - a. Manufacturer's certification stating installed materials are compatible with each other, suited for locale and purpose intended, and shipped in sufficient quantity to ensure proper, timely installation.
    - b. Manufacturer's approval of method of installation including proposed fasteners.
    - c. Manufacturer's approval of Installer.
    - d. Installer's experience record.



- e. Confirmation that installed materials meet Roofing Manufacturer's published performance requirements for specified warranty.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Obtain primary sheet roofing materials from a single manufacturer.
  - 2. Provide secondary materials as recommended in writing by manufacturer of primary materials.
  - 3. Manufacturer's qualified technical representative will be required to visit project site to advise Installer of procedures and precautions for installation of roofing materials and to verify warranty inspection requirements. Manufacturer's representative shall make inspection of the membrane installation a minimum of three times. Manufacturer's written reports of findings shall be submitted for Architect and Owner's review.
  - 4. Provide primary products, including each type of flexible sheet roofing and sheet flashing produced by a single manufacturer, which has produced that type product successfully for not less than 5 years. Provide accessory products which are acceptable to manufacturers of primary products.
- B. Product Quality Assurance Program: Primary roofing materials shall be manufactured under a quality management system that is monitored regularly by a third party auditor under the ISO 9001:2000 audit process. A certificate of analysis for reporting/confirming the tested values of the actual material being installed on the project will be required prior to project close-out.
- C. Applicator Qualifications: Five years successful experience in installation of roofing systems similar to system for this project. Trained and currently certified by Roofing Membrane Manufacturer for installation of the specified roofing system.
- D. Compatibility of Roofing System: Roof insulation, roof crickets and tapered insulation roof system shall be compatible with the roofing materials to be used and shall be approved by the Roofing Membrane Manufacturer.
- E. Provisions for Expansion: If in the Manufacturer's or Installer's expert opinion any single roofing area is large enough to require expansion joints, provide such joints whether indicated on the Drawings or not. Consult with Architect regarding exact joint locations.
- F. Pre-roofing Conference: Refer to Section 01 31 19 - *Project Meetings*.
  - 1. At least one week prior to start of roofing installation, convene pre-roofing conference at Project Site.
  - 2. Attendance is required by Contractor, Roofing Installer, Manufacturer's Technical Representative, Architect, and affected Subcontractors.
  - 3. Review requirements and conditions which could interfere with successful performance of the Work.
  - 4. Minimum Formal Written Agenda:
    - a. Review project Specifications and Drawings.
    - b. Review weather and working conditions.
      - 1) Substrate requirements.
      - 2) Insulation installation.
      - 3) Membrane installation.
      - 4) Roof terminations, flashings, and roof drain requirements, including roof drain location, i.e. minimum distance from parapets allowed by roofing membrane manufacturer. Coordinate reglet location.
      - 5) Mechanical equipment placement, supports, and height requirements.
      - 6) Inspection, testing, and quality control procedures.
      - 7) Protection requirements for construction period beyond roofing installation.
      - 8) Procedures for making roof penetrations after membrane installation.
      - 9) Water cutoffs at end of day's work.
  - 5. Conduct tour of roof deck; report discrepancies and problem areas to Architect.
- G. Local Regulations: Comply with regulations of public agencies, including specific requirements of Harris County, Texas.
- H. Primary Roofing Materials Manufacturer shall provide trained company personnel to attend scheduled job meetings regarding roofing, perform periodic inspections, and conduct a final warranty inspection upon completion of the Project.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original unopened packaging with legible labels intact.
- B. Storage:
  - 1. Store materials out of direct exposure to the weather.
  - 2. Store roll goods on end on a clean, flat, and dry surface.
  - 3. Material that must be stored on the roof overnight shall be stored on pallets in a manner so as to preclude overloading of deck and building structure.
  - 4. Store materials such as solvents, adhesives and asphalt cutback products in a flammables storage cabinet away from open flames, sparks, and excessive heat.
  - 5. Cover stored materials using a breathable cover such as a canvas. Do not use polyethylene or other non-breathable coverings.
- C. Handling: Handle materials in such a manner as to preclude damage and contamination with moisture or foreign matter. Handle rolled goods to prevent damage to edges or ends.
- D. Damaged Material: Materials that are found to be damaged or stored in a manner other than stated above will be automatically rejected, removed and replaced at the Contractor's expense.

## 1.6 PROJECT CONDITIONS

- A. Requirements Prior to Roofing Start
  - 1. Notification: Give at least 5 days notice to Owner and Manufacturer prior to commencing roofing work. Notify both parties on a daily basis of changes in work schedule.
  - 2. Safety: Familiarize every member of the Installer's crew with fire and safety regulations recommended by OSHA, NRCA and other industry or local governmental groups.
- B. Environmental Requirements
  - 1. Precipitation: Do not apply roofing materials during precipitation or if there is a probability of precipitation during application. Take adequate precautions to ensure materials, applied roofing, and building interiors are protected from possible moisture damage or contamination.
- C. Protection Requirements
  - 1. Membrane Protection: Provide protection against staining and mechanical damage for newly applied roofing and adjacent surfaces throughout this project.
  - 2. Required Torch Safety for roofing installation personnel handling torches:
    - a. Trained and certified by an authorized Certified Roofing Torch Applicator (CERTA) Trainer according to the National Roofing Contractor's Association (NRCA) guidelines.
    - b. Follow torch safety practices required by Installer's Insurance Carrier.
  - 3. Fire Watch: Designate one person on each crew as daily Fire Watch
    - a. Fire Watch shall observe roofing installation and watch for smoke, fire, and smoldering material in/on areas of roof construction.
    - b. Continue Fire Watch after roofing application has been suspended for the day.
    - c. Fire Watch shall have no other duties while performing as Fire Watch
  - 4. Debris Removal: Remove roofing debris daily from Owner's property and legally dispose of.
- D. Asphalt Fume Control: It is essential that the fumes resulting from the execution of this work be minimized in the atmosphere around the campus to the greatest extent possible. Any means may be used to reduce the presence of asphaltic fumes, with the following being minimum requirements:
  - 1. Conventional kettle application with approved fume recovery system.
  - 2. Enclosed tanker application with internal heating element and recycle fume recovery system.
  - 3. Extension of all existing air intake devices in effected areas to an upwind position.
  - 4. Providing emergency ventilation of any areas which become areas of complaints by the Owner.

## 1.7 WARRANTY

- A. Roof Membrane Warranty: Siplast Twenty-Year Total System Warranty.
  - 1. Upon successful completion of the project, and after post-installation procedures have been completed, furnish Owner with Manufacturer's Twenty Year Full System Warranty.
  - 2. Warranty shall be a term type, without deductibles or limitations on coverage amount, and shall be issued at no additional cost to the Owner.
  - 3. Warranty shall not exclude random areas of ponding from coverage.

4. Warranty shall be Cypress-Fairbanks Independent School District Full Roof System Guarantees - #1 and #4 or #3 and #4 as provided by Siplast, Inc.
  5. Include regularly scheduled roof inspection and routine preventive maintenance, minimum two times per year, during the life of the warranty. Provide Owner with a complete written report after each inspection stating the current condition of the roofing system and what maintenance was performed.
  6. If the Manufacturer or approved Installer fail to perform repairs during the warranty period within 72 hours of notification, emergency repairs performed by others shall not void the warranty.
- B. Special Project Warranty: Submit 2 executed copies of standard 5-year "Applicator's Roofing Guarantee" covering work of this section including roofing membrane, flashing, lightweight concrete deck, roof insulation and roofing accessories, signed and countersigned by installer (roofer) and Contractor. The warranty will be held jointly with the Bonding Company for the first two (2) years and the manufacturer for the remaining three (3) years.

## 1.8 INSPECTIONS

- A. The Owner and Manufacturer's representative shall have access to the job site as work progresses.
- B. Owner:
1. Owner will provide full-time quality assurance observations during progress of roofing work, limited to eight (8) hours a day, five (5) days a week and 20 days a month.
    - a. Notify Architect and Owner a minimum of 14 days prior to start of roofing work
    - b. Pay additional costs for overtime work for the Owner's Observer beyond eight (8) hours per day, five (5) days per week and 20 days per month; for weekend, holidays, etc.; and for costs associated with Contractor not showing up for a scheduled inspection.
    - c. Overtime work for Owner's Observer will be billed at an hourly rate of \$64.00.
  2. Owner's Observer, if deemed necessary, will notify in writing who in the Contractor's organization they want to inspect the work on the roof in addition to the Contractor's normal inspection.
    - a. If the designated person or persons requested by the Owner's Observer fails to respond within 48 hours to the request, the work may be suspended, payment withheld and/or liquidated damages outlined in the specifications assessed until such time as the individual(s) inspect(s) the work with the Owner's Observer.
  3. Neither the presence nor absence of the Architect's Representative nor the Manufacturer's representative, nor an inspection by the Manufacturer of the work or operation of the Contractor, nor a failure by the Manufacturer to detect, pinpoint, or object to a defect in the work completed, nor a deviation from these specifications, nor the acceptance by the Manufacturer of such defect or the approval of the Manufacturer of such deviation, shall relieve the Contractor, or reduce, limit, or divide his full responsibility for the full performance of the work required of him under these Specifications.
  4. It shall be understood that such field inspection as the Architect's Representative may cause to be performed by the Material Manufacturer, will be performed by the Material Manufacturer solely for the benefit of the Architect and in an attempt to assist with the requirements of this Specification. These requirements bind the Contractor even without such inspection.
  5. No inspection or act or omission of either the Architect's Representative or the Manufacturer's Representative in connection with such inspection shall prejudice the Architect's right to strict conformance, or be construed to excuse or mitigate a mistake or non-conformance by the Contractor.
- C. Manufacturer:
1. An authorized representative of the Roofing Material Manufacturer shall inspect the roofing progress at least three (3) times per week during roofing installation to ensure that the Work is installed according to the Manufacturer's printed instructions and written recommendations.
    - a. Daily written reports by the Manufacturer shall be turned over to the Architect, Roof Inspection Firm, and Owner on each Monday following the prior week.
    - b. Upon approval of the project, the specified warranty or warranties shall be written.
  2. The authorized Material Manufacturer's Field Representative is responsible for the following:
    - a. Notice to Contractor and Architect's Representative after performing inspections regarding the progress and quality of work observed.
    - b. Notice to Contractor and Architect's Representative regarding observed matters considered to be in violation of the Contract Documents.
    - c. Notice to Architect's Representative in writing, regarding failures or refusal of Contractor to correct unacceptable practices called to his attention.
    - d. Confirming, after completion of the work and based on his observations and tests, that he has not observed any installation procedures in conflict with these Specifications.
    - e. Final payment will not be released until Architect has received specified warranties.

- f. Having Roofing Manufacturer issue a certification that roofing system has been installed according to specified requirements, Manufacturer's instructions, and approved Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Roof Insulation: As specified in Section 03 52 16 – INSULATING CONCRETE DECKS.
- B. Crickets and Cants: Provide crickets and cants at locations as shown and coordinated with Section 03 52 16 – INSULATING CONCRETE DECKS. Crickets and cants must be compatible with modified bituminous roofing material.
- C. Steep Asphalt: ASTM D312, Type IV.

### 2.2 MODIFIED BITUMEN SHEET ROOFING MATERIALS

- A. Modified Base Sheet: A fiberglass reinforced, Styrene-Butadiene-Styrene (SBS) modified asphalt coated sheet, having an average weight of 28 pounds per square.  
Siplast Parabase Plus

### 2.3 ROOFING MEMBRANE ASSEMBLY

- A. An assembly consisting of 2 plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified modified asphalt membrane, fully adhered over a mechanically attached rigid insulation substrate. Both reinforcement mats shall be impregnated/saturated and coated each side with an SBS modified bitumen blend and coated one side with a torch grade SBS bitumen blend adhesive layer. The cross sectional area of the sheet material shall contain no oxidized or non-SBS modified bitumen. The adhesive layer shall be manufactured using a process that embosses the surface with a grooved pattern to provide optimum burn off of the plastic film and to maximize application rates. The roof system shall pass 500 cycles of ASTM D5849 Resistance to Cyclic Joint Displacement (fatigue) at 14°F. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles. The roof system shall pass 200 cycles of ASTM D5849 after heat conditioning performed in accordance with ASTM D5147. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.

Siplast Paradiene 20 TG/30 FR TG torchable roof system

- 1. Modified Bitumen Base and Stripping Ply
  - a. Thickness: ASTM D5147, average 114 mils
  - b. Thickness: ASTM D5147, minimum 110 mils
  - c. Weight: Minimum 76 lb per 100 ft<sup>2</sup> of coverage
  - d. Filler content in elastomeric blend: Maximum 35% by weight
  - e. Low temperature flexibility @ -15°F: ASTM D5147, PASS
  - f. Peak Load @ 73°F: ASTM D5147, average 30 lbf/inch
  - g. Peak Load @ 0°F: ASTM D5147, average 75 lbf/inch
  - h. Ultimate Elongation @ 73°F: ASTM D5147, 50%
  - i. Dimensional Stability: ASTM D5147, maximum 0.1%
  - j. Compound Stability: ASTM D5147, minimum 250°F
  - k. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
  - l. Reinforcement: Fiberglass mat or other meeting specified performance and stability criteria.  
Siplast Paradiene 20 - torchable grade
- 2. Modified Bitumen Cap Sheet
  - a. Thickness: ASTM D5147, average 138 mils
  - b. Thickness at selvage (coating thickness): ASTM D5147, average 118 mils
  - c. Thickness at selvage (coating thickness): ASTM D5147, minimum 114 mils
  - d. Weight: Minimum 112 lb per 100 ft<sup>2</sup> of coverage
  - e. Filler content in elastomeric blend: Maximum 35% by weight
  - f. Low temperature flexibility @ -15°F: ASTM D5147, PASS
  - g. Peak Load @ 73°F: ASTM D5147, average 30 lbf/inch
  - h. Peak Load @ 0°F: ASTM D5147, average 75 lbf/inch
  - i. Ultimate Elongation @ 73°F: ASTM D5147, 55%
  - j. Dimensional Stability: ASTM D5147, maximum 0.1%

- k. Compound Stability: ASTM D5147, minimum 250°F
- l. Granule Embedment: ASTM D5147, maximum loss of 2.0 grams per sample
- m. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
- n. Reinforcement: Fiberglass mat or other meeting specified performance and stability criteria
- o. Surfacing: Ceramic granules  
Siplast Paradiene 30 FR - torchable grade

## 2.4 FLASHING MEMBRANE ASSEMBLY

- A. An assembly consisting of a prefabricated, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane with a continuous, channel-embossed metal-foil surfacing. The finish ply shall conform to ASTM D 6298 and the following physical and mechanical property requirements.  
Siplast Veral flashing system, aluminum finish
  - 1. Metal-Clad Modified Bitumen Flashing Sheet
    - a. Thickness: ASTM D5147, average 150 mils
    - b. Thickness: ASTM D5147, minimum 146 mils
    - c. Weight: Minimum 96 lb per 100 ft<sup>2</sup> of coverage
    - d. Coating Thickness – back surface: ASTM D5147, minimum 40 mils
    - e. Filler content in elastomeric blend: Maximum 35% by weight
    - f. Low temperature flexibility @ 0°F: ASTM D5147, PASS
    - g. Maximum Load @ 73°F: ASTM D5147, average 85 lbf/inch
    - h. Maximum Load @ 0°F: ASTM D5147, average 180 lbf/inch
    - i. Elongation @ 5% Maximum Load @ 73°F: ASTM D5147, average 45%
    - j. Tear-Strength: ASTM D5147, average 120 lbf
    - k. Dimensional Stability: ASTM D5147, maximum 0.2%
    - l. High Temperature Stability: ASTM D5147, minimum 225°F
    - m. Cyclic Thermal Shock Stability: ASTM D6298, maximum 0.2%
    - n. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
    - o. Reinforcement: fiberglass scrim mat or other meeting the performance and dimensional stability criteria
    - p. Surfacing: aluminum metal foil  
Siplast Veral Aluminum
  - 2. Flashing Reinforcing Ply - Same as roof system base ply

## 2.5 ACCESSORIES AND RELATED MATERIALS

- A. Reglet and Flashing Devices: Fry Type SM, surface mounted reglet with Springlok flashing.
  - 1. Reglet:
    - a. 24 gage galvanized steel with slots punched 12 inches on center.
    - b. Furnished with stainless steel drive pins with neoprene facing.
  - 2. Flashing: Form of 24 gage metal to fit the reglet.
- B. Bituminous Cutback Materials
  - 1. Primer: ASTM D41, high flash, quick drying, asphalt solvent blend.  
Siplast PA-1125 Asphalt Primer by Siplast/Icopal; Irving, TX
  - 2. Mastics: ASTM D4586 Type II, asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges.  
Siplast PA-1021 Plastic Cement by Siplast/Icopal; Irving, TX
- C. Sealant: Moisture-curing, non-slump elastomeric sealant designed for roofing applications and approved by Roof Membrane Manufacturer for use with the specified roof membrane materials.  
Siplast PS-304 Elastomeric Sealant by Siplast/Icopal; Irving, TX
- D. Ceramic Granules: No. 11 grade specification ceramic granules, same color as cap sheet granule surfacing.
- E. Walkway Pads: Prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface.
  - a. Thickness: 0.217 inch
  - b. Weight: 1.8 lb/ft<sup>2</sup>
  - c. Width: 30 inches  
Paratread Roof Protection Material by Siplast / Icopal; Irving, TX

- F. Mechanical Fasteners:
  - 1. Minimum 0.200 diameter shank and 0.250 diameter thread. Use with Factory Mutual approved round pressure plates.
  - 2. Corrosion protection: Exhibit maximum 10 percent red rust when subjected to 30 Kesternich cycles.
  - 3. Do not use fasteners long enough to penetrate bottom flutes of the metal roof deck.
- G. Roof Vents: Provide FP-10 One-Way Roof Vents as Manufactured by Schuller Roofing Systems or approved equivalent.
- H. Tapered Edge Strip: Manufactured by Cant Products or other pre-approved equal.
  - 1. Thickness: Taper from 1-1/2 to 0 inches
  - 2. Face size: 18x48 inches

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Do not begin roofing installation until all other roof work is complete and inspected. Verify the following:
  - 1. Insulating Concrete deck is poured and completely cured and ready for application of modified bituminous roof membrane.
  - 2. Roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and cant strips, blocking, and nailing strips are securely in place.
- B. Substrate must be dry and free of oil, dirt, grease, sharp edges, and debris. Sweep, vacuum, or clean water wash as recommended by Membrane Manufacturer.
- C. Verify Roof deck is free of depressions, waves, and projections, and is properly sloped to drains.
- D. Beginning of installation indicates Installer accepts existing conditions.

### 3.2 INSULATING CONCRETE DECK

- A. Insulating concrete deck: As specified in Section 03 52 16 – INSULATING CONCRETE DECKS.

### 3.3 PREPARATION OF SURFACES

- A. Base Sheet Securement to Prepared Substrate: Lay the base sheet over entire area to be roofed, lapping sides 3 inches and ends 6 inches. Using the specified fasteners, fasten each sheet in a fastening pattern to be determined by the manufacturer to meet the uplift pressures for the field, corners and perimeters.
- B. Venting Base Sheet Application to Prepared Substrate: Lay the venting base dry over the area to be roofed, lapping sides and ends a maximum of 1 inch. Using the specified fasteners, fasten each sheet in a fastening pattern to be determined by the manufacturer to meet the uplift pressures for the field, corners and perimeters.

### 3.4 INSTALLING ROOFING MEMBRANE

- A. Apply roofing according to Roofing System Manufacturer's instructions. Application of roofing membrane components shall immediately follow application of base sheet and/or insulation as a continuous operation.
- B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a requirement. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder), and exercise care in ensuring that the finished application is acceptable to the Owner.
- C. Priming: Prime metal flanges (jacks, edge metal, lead drain flashings) and concrete and masonry surfaces with a uniform coating of ASTM D41 asphalt primer.
- D. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
- E. Roofing Application: Apply layers of roofing free of wrinkles, creases and fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
  - 1. Apply layers of roofing perpendicular to the slope of the deck.

2. Fully bond Base Ply to prepared substrate with minimum 3 inch side and end laps. Apply each sheet directly behind Asphalt Applicator. Cut a dog ear angle at the end laps on overlapping selvage edges. Use a clean trowel to apply top pressure to top seal T-laps immediately following sheet application. Stagger end laps a minimum of 3 feet.
  3. Fully bond Finish Ply to Base Ply, with minimum 3 inch side and end laps. Apply each sheet directly behind Asphalt Applicator. Stagger end laps of Finish Ply a minimum 3 feet. Cut a dog ear angle at the end laps on overlapping selvage edges. Use a clean trowel to apply top pressure to top seal T-laps immediately following sheet application. Stagger side laps of Finish Ply a minimum 12 inches from side laps in the underlying Base Ply. Stagger end laps of Finish Ply a minimum 3 feet from end laps in underlying Base Ply.
  4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof slope exceeds 1/2-inch per foot. Provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.
- F. Granule Embedment: Broadcast mineral granules over all bitumen overruns on Finish Ply surface while bitumen is still hot, to ensure a monolithic surface color.
- G. Flashing Application - Masonry Surfaces: Flash masonry parapet walls and curbs using reinforcing sheet and metal foil flashing membrane.
1. After Base Ply has been applied to top of the cant, fully adhere reinforcing sheet with minimum 3 inch side laps, and extend a minimum of 3 inches onto Base Ply surface and 3 inches up the parapet wall above the cant.
  2. After Final Roofing Ply has been applied to top of the cant, prepare surface area to receive flashing coverage by torch heating granular surfaces, or by application of asphalt primer; allowing primer to dry thoroughly.
  3. Torch-apply the metal foil-faced flashing into place using three foot widths (cut off the end of roll) always lapping factory selvage edge.
  4. Stagger laps of metal foil flashing layer from lap seams in reinforcing layer.
  5. Extend flashing sheet a minimum of 4 inches beyond toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height.
  6. Exert pressure on flashing sheet during application to ensure complete contact with wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag.
  7. Check and seal all loose laps and edges.
  8. Nail top edge of flashing at 9 inches on center. Refer to Manufacturer's schematic for visual interpretation.
- H. Flashing Application - Wood Surfaces: Flash plywood parapet walls and curbs using reinforcing sheet and metal foil flashing membrane.
1. Reinforcing sheet shall have minimum 3 inch side laps and extend a minimum of 3 inches onto the base ply surface and to the top of the parapet wall or curb.
  2. Nail reinforcing sheet through field of the sheet to vertical wood surface at 12 inches on center from top of cant to top of the wall or curb.
  3. Fully adhere remainder of the flashing reinforcing sheet that extends over the cant and roof level.
  4. After Final Roofing Ply has been applied to top of the cant, prepare surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly.
  5. Torch apply metal foil-faced flashing into place using three foot widths (cut off the end of roll) always lapping factory selvage edge.
  6. Extend flashing sheet a minimum of 4 inches beyond toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height.
  7. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag.
  8. Check and seal loose laps and edges.
  9. Nail top edge of flashing at 9 inches on center. Refer to Manufacturer's schematic for visual interpretation.
- I. Flashing Application - Surface mounted Reglet:
1. Install surface mounted reglets true to lines and levels.
    - a. Clean surface of oil, grease and loose particles.
    - b. Place continuous sealant bead in groove on back of reglet and on lap surfaces.
    - c. Secure reglet in precise alignment to wall with power driven pins spaced 16 inches on center.
    - d. Lap joints 3 inches and bed in sealant. Miter and seal corners.
    - e. Install continuous sealant bead at top of reglet
  2. Install Springlok flashing:
    - a. Lap flashing down over roof membrane approximately 4 inches and form lower edge with a spring bend against the membrane and a drip edge.

- b. After roofing and flashing strip have been installed, snap flashing up into reglet so that it is held securely in place without screws or clips.
  - c. Lap end joints 3 inches and bed in sealant. Miter and seal corners.
- J. Water Cut-Off:
  - 1. At end of each day's work, or when precipitation is imminent, construct a water cut-off at open edges.
  - 2. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service.
  - 3. Completely remove cut-offs prior to resumption of roofing.
- K. Apply a smooth continuous bead of specified sealant at exposed finish ply edge transitions to metal flashings incorporated into the roof system. Refer to Section 07 92 00 - *Joint Sealants*.

### 3.5 FIELD QUALITY CONTROL

- A. Site Condition: Leave areas around job site free of debris, roofing materials, equipment and related items.
- B. Notification of Completion: Submit completed Manufacturer's printed Notification of Completion to schedule a final inspection date.
- C. Final Inspection/Post-Installation Meeting: Hold a meeting at the completion of the project, attended by every party that was present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the Manufacturer's Representative. Complete, sign, and mail the punch list form to the Manufacturer's headquarters.
- D. Issuance of the Warranty: Complete post installation procedures and meet the Manufacturer's final endorsement for issuance of the specified guarantee.

### 3.6 TERMINATIONS

- A. Provide water cutoffs at end of each day's work.
- B. Pull membrane loose from water cutoff and remove contaminated material before resuming work.

### 3.7 WALKWAY PROTECTION

- A. Install walkway protection pads as indicated.

END OF SECTION



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## ROOFING WARRANTY

WHEREAS \_\_\_\_\_

of (Address) \_\_\_\_\_

herein called the "Roofing Contractor", has performed roofing and associated work ("work") on following project:

Owner: \_\_\_\_\_

Address: \_\_\_\_\_

Name and Type of Building: \_\_\_\_\_

Address: \_\_\_\_\_

Area of Work: \_\_\_\_\_ Date of Acceptance: \_\_\_\_\_

Warranty Period: \_\_\_\_\_ Date of Expiration: \_\_\_\_\_

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

NOW THEREFORE Roofing Contractor hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in watertight condition.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by: a) lightning, windstorm; b) fire; c) failure of roofing system substrate including cracking, settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work; e) vapor condensation on bottom of roofing; and f) activity on roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

2. The Roofing Contractor is responsible for damage to work covered by this Warranty, but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

3. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Contractor, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void upon date of said alterations, but only to extent said alterations affect work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall have notified Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this warranty.

4. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void upon date of said change, but only to extent said change affects work covered by this Warranty.

5. The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect, or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work, and to examine evidence of such leaks, defects, or deterioration.

6. This Warranty is recognized to be the only warranty of Roofing Contractor on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Contractor of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

\_\_\_\_\_  
Installation Company

\_\_\_\_\_  
By

\_\_\_\_\_  
Title

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
FAX Number

ATTEST:

\_\_\_\_\_  
Secretary

IN WITNESS THEREOF, this instrument has been duly executed this

\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

(INSERT APPROPRIATE EXECUTION FORM)

\* \* \* \* \*

SECTION 07 59 00

ROOFING REPAIR

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Modified Bitumen Roof repair work as a result of penetrations made or damage occurring to the roof membrane and flashings as part of the work of this contract.
  - 1. In order to maintain the existing warranty where new roofing will be tied into existing roofing, before beginning work Contractor shall confirm manufacturer of existing roof system and obtain written approval from the existing roof manufacturer.
- B. Related Sections:
  - 1. Section 07 55 52 - Modified Bituminous Membrane Roofing.
  - 2. Section 07 62 00 - Sheet Metal Flashing and Trim.
  - 3. Section 07 72 13 - Manufactured Roof Curbs and Portals.
  - 4. Section 07 72 33 - Roof Hatches.
  - 5. Division 22 - Plumbing.
  - 6. Division 23 - Heating, Ventilating and Air Conditioning.
  - 7. Division 26 - Electrical.

1.2 SYSTEM PERFORMANCE

- A. Flash, seal, counterflash and otherwise make watertight all roof membrane penetrations and repair all damages leaving membrane and flashings in a watertight condition.

1.3 SUBMITTALS

- A. General: Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Shop Drawings: Indicate layout, details, dimensions and interface with adjoining work.
- C. Product Data:
  - 1. Submit all data concerning each roof to be repaired.
  - 2. Submit written approval from the existing roof manufacturer that warranty shall be maintained.

1.4 QUALITY ASSURANCE

- A. Installer: Company specializing in roofing flashing and repair work with minimum 3 years experience. Use recommended detailing as indicated in NRCA Roofing Manual.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials during inclement weather or when temperatures are below 40°F.

1.6 COORDINATION

- A. Coordinate placement of curbs for roof mounted equipment with new openings cut into roof structure.

1.7 WARRANTY

- A. Maintain existing warranties.
- B. Provide a 2-year watertightness warranty from date of substantial completion for work of this section.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS AND PRODUCTS

- A. Utilize identical sheet, fluid-applied and bituminous materials, flashings, roof surfacing, fasteners, adhesives and accessories as original installation. On pipe penetrations, use flashing materials and techniques as recommended by NRCA utilizing portals mounted to curbs.

### 2.2 PERFORMANCE/DESIGN CRITERIA

- A. Wind Up-lift Requirements: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressures calculated according to ASCE-7. Wind uplift pressures for this area, based on a 3-second gust of [90] [120] [149] miles per hour.

### 2.3 ASPHALT FUME CONTROL

- A. It is essential that the fumes resulting from the execution of this work be prohibited from entering any of the existing buildings on campus and minimized in the atmosphere around the campus in the exterior.
- B. Contractor may elect any means of his choice to reduce the presence of asphaltic fumes, but the following are the minimum requirements:
  - 1. Conventional kettle application with approved fume recovery system.
  - 2. Enclosed tanker application with internal heating element and recycle fume recovery system.
  - 3. Extension of all existing air intake devices in affected areas to an upwind position.
  - 4. Providing emergency ventilation of any areas which become areas of complaints by the Owner.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Protect existing building surfaces against damage from roofing installation.

### 3.2 PREPARATION

- A. Prepare roof surfaces as recommended by manufacturer of original installation.

### 3.3 FLASHING AND REPAIR WORK

- A. General: Perform work in strict accordance with instructions and recommendations of the manufacturer of original installation materials.
- B. Cut holes for penetrations.
- C. Lay base flashing and seal down to membrane and penetration.
- D. Strip in flashing with multiple layers of felt and bitumen on built-up systems and with one layer of sheet material on single-ply systems.
- E. Counterflash as required to make watertight.
- F. On built-up systems, re-install surfacing into flood coat of bitumen.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sheet metal flashing and trim.
- B. Related Sections:
  - 1. Section 07 55 52 - Modified Bituminous Membrane Roofing.
  - 2. Section 07 51 50 - Built-up Bituminous Roofing Repair.
  - 3. Section 07 71 13 - Manufactured Copings.
  - 4. Section 07 92 00 - Joint Sealants.
  - 5. Section 09 91 00 - Painting.

1.2 SUBMITTALS

- A. Samples:
  - 1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
  - 2. Submit for approval samples of parapet coping cover expansion joint and soldered joint.
- B. Product Certificates: Showing that each type of coping and roof edge flashing is ANSI/SPRI/FM 4435/ES-1 tested.
- C. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

1.3 QUALITY ASSURANCE

- A. Standard: Comply with the requirements of the Architectural Sheet Metal Manual published by SMACNA.
- B. Installer Qualifications: Company specializing in sheet metal flashing work with three years minimum experience in similar sized installations

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle and protect products under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- B. Stack pre-formed material to prevent twisting, bending, and abrasions, and to provide ventilation.
- C. Prevent contact with materials which may cause discoloration or staining.

1.5 WARRANTY

- A. Furnish to the Owner a written warranty providing the following without cost to the Owner.
  - 1. Sheet metal roof flashings shall be maintained in normal repair and free of leaks for a period of 2 years from the date of acceptance of the roof.
  - 2. At end of 2-year period, Owner and Contractor shall make final inspection of flashing work. Holes, breaks and other defects shall be promptly repaired at the Contractor's expense.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Metal:
  - 1. Roof top accessories, including but not limited to, expansion joint covers, flanges, and concealed counterflashings not visible from ground level shall be stainless-steel, ASTM A 666, unless jurisdiction requires ASTM A 240, Type 304, dead soft, fully annealed, with smooth, flat surface.
    - a. Minimum 24 gauge thickness unless noted otherwise.

- b. Finish: 2D (dull, cold rolled)
- 2. Areas which can be seen from the ground level, including but not limited to, coping, edging, gutters, conductor heads, downspouts, and expansion joint terminations shall be ASTM B209 aluminum sheet, alloy and temper recommended by manufacturer for use and finish indicated prefinished with fluorocarbon coating containing 70% Kynar 500. Colors shall be selected by Architect from Fluropon Standard colors as manufactured by Valspar.
- B. Reglet: Two piece snaplock receiver, Per Figure 4-4C, SMACNA Manual, 8th Edition, of 24 gauge stainless steel.
- C. Underlayment: ASTM D 226, 30 lb/100 s.f. weight felt containing no additives corrosive to sheet metals.
- D. Solder: ASTM B 32, made from block tin and pig lead (50/50) with no antimony.
- E. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- F. Solder for Lead: ASTM B 32, Grade Sn50, ASTM B 32, made from block tin and pig lead (50/50) with no antimony.
- G. Burning Rod for Lead: Same composition as lead sheet.
- H. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- I. Sealant: Two component polyurethane, non-sagging, sealant as specified in SECTION 07 92 00 - JOINT SEALANTS.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- K. Miscellaneous items such as nails and mastic shall be furnished as required by the conditions of use and must be of the best grade available.

## 2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, free from distortion and defects, to profiles indicated in accordance with SMACNA Architectural Sheet Metal Manual.
- B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.
- C. Form pieces in longest practical lengths.
- D. Hem exposed flashings on underside ½"; miter and seam corners.
- E. Solder and seal metal joints except those indicated or required to be expansive type joints. After soldering, remove flux. Wipe and wash solder joints clean.
- F. Fabricate inside and outside corners from one piece of material with no seam at corner and with legs not less than 18 inches in length extending both ways from corner. Ease exposed point of outside corners by grinding in factory to reduce sharpness. Seal to adjacent flashings with sealant.
- G. Fabricate vertical faces with bottom edge formed outward ¼" and hemmed to form drip.
- H. Fabricate flashings to allow toe to extend minimum 2" over wall surfaces.
- I. Fabricate as much as possible in shop with machinery to eliminate as much hand tooling on the job as possible. Shop fabricate to allow for adjustments in the field for proper anchoring and joining.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
- B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- C. Verify membrane termination and base flashings are in place, sealed, and secure.

### 3.2 PREPARATION

- A. Field measure site conditions prior to fabricating work.
- B. Install starter and edge strips, and cleats before starting installation.
- C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- D. Install one layer of underlayment prior to installing copings.

### 3.3 INSTALLATION

- A. General: Fabricate, assemble, and install sheet metal work in conformance with referenced standard.
  - 1. Make adequate provision for metal expansion and contraction without buckling or splitting. Use cleats and watertight slip and expansion joints.
  - 2. Nails and screws shall be of the same metal as the member on which used. Nails through exposed wash surfaces will not be permitted.
  - 3. When soldering, use flux and wash off surplus flux after soldering has been completed.
  - 4. Set sheet metal with horizontal lines straight and level. Surfaces shall be flat without wrinkles and waves. Profiles shall align at joints with no offsets.
  - 5. Conform to drawing details included in manuals published by SMACNA and NRCA.
  - 6. Edge Securement for Low-Slope Roofs: Design according to ANSI/SPRI ES-1 for 150 wind speed zone with 3-second gusts. (ASD wind speed of 116.2 mph) Reference Structural drawing notes for uplift pressures.
  - 7. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
  - 8. Seal metal joints watertight.
  - 9. Provide electrolytic separation between dissimilar metals with protective back paint.
- B. Reglets and Reglet Counterflashing: Refer to Section 07 55 52 - MODIFIED BITUMINOUS MEMBRANE ROOFING
- C. Parapet Coping Cover: Form and install coping covers and fascia covers of 0.040-inch thick aluminum. Finish coping covers/fascia with a fluorocarbon coating containing 70% Kynar 500. Color shall be selected from Fluropon Standard colors as manufactured by Valspar.
  - 1. Make up the coping in 10 ft. lengths.
  - 2. Bend outside bottom edge to form drip and lock to continuous cleat, 22 gage min., secured to wood blocking with nails and to masonry with screws into expansion shields.
  - 3. On roof side copings shall be fastened through slotted holes located 2' o.c. with screws and watertight washers.
  - 4. Provide loose-locked expansion joints filled with sealant where each 10' section meets. Provide an expansion joint within 10 ft. of each corner.
  - 5. Corners shall be mitered, locked and soldered seams.
- D. Vent Stack Roof-Penetration Flashing: Flashing shall be lead sheet with weight of 4 lbs/sq. ft. Coordinate installation of roof-penetration lead flashing flange with installation of roofing and other items penetrating roof. Base flashing shall be flanged 4 in. onto the roof. The flange is fastened through the roofing felts and is then stripped in by the roofer. Turn the top of the flashing down inside the vent pipe. Seal with sealant per Section 07 92 00 – Joint Sealants, and clamp flashing to pipes that penetrate roof.



- E. Roof Expansion Joint Cover: Form continuous covers and flashing from 24-gauge stainless steel sheet and install as required to make the roof expansion joints watertight.
  - 1. Install covers over the ice and watershield on wood curbs and nail flanges to the wood curbs in accordance with roofing membrane manufacturer's instructions.
  - 2. Strip the flanges with base flashing as specified in SECTION 07 55 52 - MODIFIED BITUMEN SHEET ROOFING.
  - 3. At wall intersections, nail upper vertical flange to wall just below receiver reglet and seal top edge and nail heads with roof cement.
  - 4. Compressible Insulation: Faced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation In-fill: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on both faces, 1-1/2" thick.
  - 5. Vapor Retarder: Vapor retarder membrane shall be 45 mils EPDM, minimum 24" roll width. Drape vapor retarder down into expansion joint the full depth of the joint, and secure to face of wall and to top of expansion joint curb. Install in continuous length, without joints. Install in-fill insulation per detail.
  - 6. Ice and Watershield Underlayment: Provide Ice & Watershield self-adhered roofing underlayment as manufactured by Grace Construction Products. Extend membrane over expansion joint opening and secure to face of wall and front face of expansion joint curb nailer with screws (do not secure to top of curb).
  - 7. Splice joints and intersections of covers in accordance with the manufacturer's instructions.
- F. Miscellaneous flashings and other items of sheet metal roof work shall be provided as required for a weathertight job.

END OF SECTION

SECTION 07 65 00

FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Concealed through-wall flashing system.
- B. Related Sections:
  - 1. Section 04 20 00 - Masonry Units.
  - 2. Section 05 40 00 - Cold-formed Metal Framing.
  - 3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System.
  - 4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.

1.2 GENERAL

- A. Contractor shall review American Concrete Institute 530.1 mandatory specification checklist for additional requirements necessary for specific project.

1.3 QUALITY ASSURANCE

- A. At a scheduled pre-construction meeting with all trades, contractor shall review flashing for the project and how the flashing shall be sequenced with the following: below grade waterproofing, air and vapor system, window installation, sealant installation, relief angles and roofing.

1.4 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Contractor shall provide from the manufacturer a review of the flashing design for the project and location of preformed shapes on reduced floor plan.
- C. Product Certificates: From flexible flashing manufacturer, certifying compatibility (including adequate adhesion) of flexible flashing and accessory materials with Project materials that connect to or that come in contact with flexible flashing.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.
- B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be a minimum of four inches (4") off the substrate, and the tarpaulin tied off with rope.
- C. Deliver materials in sufficient quantity to allow continuity of work.
- D. Handle and store material in such a manner as to avoid damage.
- E. Protect materials against damage by construction traffic.
- F. Storage: All materials should be stored under cover to avoid site damage. During cool weather construction, store materials inside at 50° F or higher.
- G. The proper storage of materials is the sole responsibility of the contractor and damaged materials shall be discarded, removed from the project site, and replaced prior to application.

## 1.6 SITE CONDITIONS

- A. Job Condition Requirements: Coordinate the work of the contractor with the work to be performed by the Owner's personnel, to ensure proper sequencing of the entire work. The contractor shall follow local, state, and federal regulations, safety standards, and codes. When a conflict exists, use the stricter document.
- B. Protection of Work and Property:
1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. He shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations shall be fulfilled by the contractor as part of his proposal.
  2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the work of this contract. Examples of two categories or degrees of protection are generally as follows:
    - a. removal, protection, preservation, or replacement and replanting of plant materials;
    - b. protection of plant materials in place, and replacement of any damage resulting from the contractor's operations.
- C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds shall be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.
- D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.
- E. Cleaning and Disposal of Materials:
1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean.
  2. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust. At completion, all work areas shall be left clean and all contractor's equipment and materials removed from the site.
  3. Debris shall be deposited at an approved disposal site.

## PART 2 - PRODUCTS

### 2.1 FLASHING MATERIALS

- A. Through Wall Shelf Flashing:
1. Stainless Steel, Type 304: Twenty-four (24) gauge; commercial quality, Fed. Spec. QQ-S-775, Type I, Class D or ASTM A 526 of lock forming quality ASTM A 527, G90 coating in accordance with ASTM A 525.
  2. Solder: ASTM B32, alloy grade 50A. Neutralize flux after soldering.
- B. Built-In Flashing Membrane (Elvaloy® Sheet)
1. The built-in flashing membrane shall be 40 mil flexible sheet material, consisting of a blend of elastomeric and thermal plastic polymers, incorporating DuPont™ Elvaloy® The membrane shall be reinforced with synthetic fibers, calendered into sheet form, rolled and cut to width.
  2. Cloaks shall be pre-formed, three-dimensional flexible units used for detail corners, level changes, stop ends, and special applications.

#### Physical Properties

Elongation	175%	ASTM D412
Tensile Strength	650 psi	ASTM D412
Tear Strength	280 psi	ASTM D624
Low Temperature Flexibility	-25° F Pass	ASTM D146
Water Absorption Less than	0.1%	ASTM D471

## 2.2 RELATED MATERIALS FOR BUILT-IN FLASHING MEMBRANE

- A. Joint Support Boards: Aid the mason in lap formation by providing a flat work surface and in-cavity support for membrane joints. The boards shall be used under all membrane to membrane laps.
- B. Double-Sided Tape: Shall be a two-sided, self-adhering tape used to seal joints in membrane and joints between membrane and cloaks. Adhesive may be used as an alternative.
- C. Drip Plate: Type 304 stainless steel, 26 ga., 3-1/2" **[2-1/2" at King Brick]** drip plate with prefabricated inside/outside corners and end dams. Basis of Design shall be Hohmann & Barnard #DP. At locations detailed without an exposed drip edge, the Basis of Design shall be #FDP.
- D. Mastic: Shall be used at all laps and joints.

## 2.3 SURFACE-ADHERED FLASHING MEMBRANE (ELVALOY® SHEET)

- A. Surface-adhered membrane shall be a composite 40 mil membrane consisting of 25 mils of elastomeric/thermal plastic membrane incorporating DuPont™ Elvaloy® and 15 mils of SBS asphaltic adhesive. The membrane shall be reinforced with synthetic fibers, calendered into sheet form, rolled and cut to standard widths.
- B. Standard Sheet Dimensions:

Thickness	40 mil
Roll length	75 ft
Roll widths	12, 18, 24, 36 in
- C. Cloaks shall be pre-formed, three dimensional flexible units used for detail corners, level changes, stop ends, and special applications.

### Physical Properties

Elongation	225%	ASTM D412
Tensile Strength	875 psi	ASTM D412
Tear Strength	270 psi	ASTM D624
Low Temperature Flexibility	-25° F Pass	ASTM D146
Water Absorption	Less than 0.1%	ASTM D471

## 2.4 RELATED MATERIALS FOR SURFACE ADHERED FLASHING MEMBRANE

- A. Double-Sided Tape: Shall be a two-sided, self-adhering tape used to seal the top of cloaks against the back-up wythe. Adhesive may be used as an alternative.
- B. Mastic: Shall be used at all laps and joints, and top terminations.
- C. Termination Bars for Flexible Flashing: Type 304 Stainless steel bars 1/8" x 1". Basis of Design shall be Hohmann & Barnard #T1.
- D. Drip Plate: Type 304 stainless steel, 26 ga., 3-1/2" drip plate with prefabricated inside/outside corners and end dams. Basis of Design shall be Hohmann & Barnard #DP. At locations detailed without an exposed drip edge, the Basis of Design shall be #FDP.
  - 1. Manufacturer shall grind down point of prefabricated outside corners to provide a rounded corner, free from sharp points and edges, prior to shipment of material.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances and other specific conditions.

### 3.2 GENERAL

- A. Laying Masonry Walls: Use an inverted lintel CMU or fully grouted hollow CMU as a base for flashing at sills, floor joints, and other similar conditions.

- B. Preparation: All sharp protrusions and mortar droppings must be removed from the substrate, and the surface must be clean and dry.
- C. Where brick work occurs about the roof elevation, provide solid protection of the existing roof system until work is complete.

### 3.3 INSTALLATION OF BUILT-IN FLASHING MEMBRANE (ELVALOY® SHEET)

- A. Set drip plate in full bed of sealant. Lap joints 3" with bead of sealant between and tooled sealant on top edge of overlap. Flashing membrane and cloaks shall be installed in a bed of fresh mortar.
- B. Weep holes shall be provided immediately above all flashing at 24-inch centers. A minimum of two weeps shall be installed above any wall opening.
- C. All joints in the flashing membrane shall be lapped a minimum of four inches (4") using double sided tape or flashing adhesive and a joint support board.
- D. Flashing membrane shall be installed six inches (6") above top of cavity drainage material.
- E. Cloaks and end dams shall be installed at all window and door heads and sills.
- F. Vertical flashing at wall openings shall extend into the wall opening one inch (1"). The door/window frame shall be installed with the flashing extending into the frame.
- G. Cleaning: Flashing membrane shall not be damaged by cavity cleaning after installation. Precautions to be taken during subsequent work are:
  - 1. Use of cavity battens to prevent mortar droppings;
  - 2. Removal of droppings before they harden;
  - 3. Never use implements such as steel rods for cleaning the cavity; and
  - 4. Inspection of cavity flashing for damage as the work proceeds.

### 3.4 INSTALLATION OF SURFACE-ADHERED FLASHING MEMBRANE (ELVALOY® SHEET)

- A. Priming: If the surface-adhered flashing membrane will not adhere to the substrate or the substrate is dusty or dirty, the area shall be primed. Flashing primer shall be applied with a brush, roller or sprayed. Coverage is approximately 400 square feet per U.S. gallon (3.78L). Drying time may vary depending on temperature, humidity, and air movement; drying time should be approximately 45 minutes.
- B. Flashing System Installation: Starting at a corner, mount cloak to substrate using double-sided tape or flashing adhesive. Cut surface adhered membrane into workable sections (8'-10'). Remove the release sheet and adhere the membrane to the inner leaf of construction lapping the membrane onto the cloak four inches (4"). Use firm hand pressure and a steel roller to totally adhere membrane in place. Extend membrane completely through the outer leaf and leave it exposed ¼" minimum. The surface-adhered membrane is not UV sensitive. Apply a bead of flashing mastic to all top termination edges.
- C. Termination Bar: The surface-adhered membrane shall be installed using a termination bar for additional attachment to the inner leaf.
- D. Weep holes shall be provided immediately above all flashing at 24-inch centers. A minimum of two baffle weeps shall be installed above any wall opening.
- E. Flashing membrane shall be installed six inches (6") above top of cavity drainage material.
- F. Stop end cloaks shall be installed at all windows, door heads, sills, and through-wall starts, stops, steps, etc.
- G. Enveloped vertical flashing at wall openings shall extend into the wall opening one inch (1"). The door/window frame shall be installed with the flashing extending into the frame. Enveloped vertical flashing shall be installed at all abutments of dissimilar exterior wall treatments: inside and outside nineties (90), etc.

- H. Cleaning: Flashing membrane shall not be damaged by cavity cleaning after installation. Precautions to be taken during subsequent work are:
1. Use of cavity battens to prevent mortar droppings;
  2. Removal of droppings before they harden;
  3. Never use implements such as steel rods for cleaning the cavity; and
  4. Inspection of cavity flashing for damage as the work proceeds.

### 3.5 FLASHING SCHEDULE

- A. Flashing as follows with membrane:
1. Over steel lintels, plates and angles in exterior masonry walls.
  2. Within masonry parapets and walls as through flashing to detail.
  3. At the bottom of cavity walls with weep holes.
  4. Under window sills to detail.
  5. Elsewhere in walls where indicated.

END OF SECTION

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SECTION 07 71 13

MANUFACTURED COPINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Prefinished coping system.
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry: Wood nailers.
  - 2. Section 07 62 00 - Sheet Metal Flashing and Trim: Custom- and site-fabricated sheet metal flashing and trim.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Manufacture and install prefinished coping system to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Water Infiltration: Provide prefinished coping system that does not allow water infiltration to building interior.

1.3 SUBMITTALS

- A. General: Submit in accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples.
- B. Product Data: Submit construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: Provide layouts of prefinished coping system, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:
  - 1. Details for fastening, joining, supporting, and anchoring prefinished coping system including fasteners, clips, cleats, and attachments to adjoining work.
  - 2. Details for expansion and contraction.
- D. Samples for Initial Selection: Manufacturer's sample finishes showing the full range of colors and textures available for units with factory-applied color finishes.

1.4 COORDINATION

- A. Coordinate installation of prefinished coping system with interfacing and adjoining construction to provide a leakproof, secure, and non-corrosive installation.

1.5 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace prefinished coping system that show evidence of deterioration of factory-applied finishes within 20 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide prefinished PAC Continuous Cleat Coping system as manufactured by Petersen Aluminum Corp. Equivalent prefinished coping systems by one of the following will be acceptable:
  - ATAS International, Inc.
  - Hickman, W.P. Company
  - Merchant & Evans, Inc.
  - MM Systems Corp.



## 2.2 EXPOSED METALS

- A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows.
  - 1. Surface: Smooth, flat finish.
  - 2. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
    - a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat (70% Kynar 500 or Hylar 5000 resin); complying with physical properties and coating performance requirements of AAMA 2605.

## 2.3 CONCEALED METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 (Z275) coating designation; structural quality.

## 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.
  - B. Fasteners: Manufacturer's recommended fasteners, suitable for application indicated.
  - C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- 2.5 Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.
- 1. Coping Caps: Snap-on, fabricated from prepainted, zinc-coated steel, 24 gage.
  - 2. Coping Cap Color: Provide custom color as selected by Architect to match metal wall panels.
  - 3. Corners: Continuously welded.
  - 4. Snap-on Coping Anchor Plates: Concealed, two-piece continuous, galvanized steel sheet, 0.028" thick, with integral cleats.
  - 5. Face Leg Cleats: Concealed, galvanized steel sheet.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, to verify actual locations, dimensions, and other conditions affecting performance of work.
  - 1. Examine walls and parapets for suitable conditions for prefinished coping system.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install prefinished coping system according to manufacturer's written instructions. Anchor prefinished coping system securely in place. Use fasteners, separators, sealants, and other miscellaneous items as required to complete prefinished coping system.
  - 1. Install prefinished coping system with provisions for thermal and structural movement.
  - 2. Torch cutting of prefinished coping system is not permitted.
- B. Install prefinished coping system level, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.
- C. Install prefinished coping system to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
- D. Expansion Provisions: Provide for thermal expansion of exposed prefinished coping system. Space movement joints at a maximum of 12 feet with no unplanned joints within 18" of corners or intersections.

### 3.3 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings to resist uplift and outward forces. Interlock face and back leg drip edges into cleats anchored to substrate at 24" centers.

### 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films as prefinished coping system is installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- B. Replace prefinished coping systems that have been damaged or that cannot be successfully repaired by finish touch-up or similar minor repair procedures.

END OF SECTION

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SECTION 07 72 13

MANUFACTURED ROOF CURBS AND PORTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Prefabricated roof curbs and penetration portals.
- B. Related Sections:
  - 1. Section 05 31 00 - Steel Decking.
  - 2. Section 05 50 00 - Metal Fabrications.
  - 3. Section 06 10 00 - Rough Carpentry: Field-constructed curbs and cants.
  - 4. Section 07 55 52 - Modified Bituminous Membrane Roofing.
  - 5. Section 07 59 00 - Roofing Repair.
  - 6. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashings and counter-flashings.
  - 7. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

- A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Indicating technical and performance data of products.
- C. Shop Drawings: Indicating details of special connections and transitions, typical section details, and layout showing intended locations for use of products.
- D. Manufacturer's Instructions: Printed instructions for recommended installation methods and sequences for all products.

1.3 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Company specializing in the manufacturing of prefabricated roof expansion joints for a minimum of 5 years.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- B. Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Acceptable Products and Manufacturers
  - 1. Roof Curbs: RPS Expansion Curbs (EC-2B, with 2" extended flange), Roof Curbs (RC-2B) and Equipment Rail (ER-2B) by Roof Products and Systems Corp., Bensenville, Illinois.
    - a. On top of equipment curbs, provide Unistrut per drawings with Unistrut RP2484EG Universal bracket.
  - 2. Pipe Mounting Pedestal: For pipes larger than 2" o.d., provide Pipe Mounting Pedestals as manufactured by PHP. Provide pad under support with spacing of hangers not to exceed 6 feet on center.
- B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

## 2.2 SIZES AND CONFIGURATIONS

- A. Provide in sizes and configurations as required to accommodate joint widths, penetrations, and equipment being supported.
- B. Provide configurations and special transitions as shown or required to utilize factory formed pieces wherever possible.
- C. Provide custom factory-formed pieces conforming to roof slope to allow for a level equipment installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.
- B. Verify that curbs are level and flashing reglets have been installed at proper locations.
- C. Verify that insulation has been packed into joint prior to beginning work.

### 3.2 INSTALLATION

- A. Interface with other systems. On roof mounted expansion joints, set flanges in adhesive and make watertight over cant strip.
- B. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.
- C. Anchor units securely with fasteners and at spacing as recommended by manufacturer.
- D. Where metal surfaces are to be in contact with corrosive substrates, apply bituminous coating on concealed metal surfaces.
- E. Splice sections of curbs together with procedures as recommended by manufacturer for a solid, watertight installation.
- F. Penetrations of piping through equipment curbs shall not be permitted.
- G. Utilize factory fabricated intersections and transitions wherever possible. Field fabricate where pre-manufactured sections are not available.

### 3.3 PROTECTION

- A. Protect completed installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

END OF SECTION

## SECTION 07 72 33

### ROOF HATCHES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Roof hatches, including ladder safety post and hatch rail system.
- B. Related Sections:
  - 1. Section 05 31 00 - Steel Decking.
  - 2. Section 05 50 00 - Metal Fabrications; angles miscellaneous metal, and ladder fall arrest systems .
  - 3. Section 06 10 00 - Rough Carpentry.
  - 4. Section 07 55 52 - Modified Bituminous Membrane Roofing.
  - 5. Section 07 62 00 - Sheet Metal Flashing and Trim: flashing of the hatch curb.
  - 6. Section 07 72 13 - Manufactured Roof Curbs and Portals.
  - 7. Section 07 92 00 - Joint Sealants.

##### 1.2 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include complete manufacturer's catalog cuts and installation requirements for each item specified.

##### 1.3 WARRANTY

- A. Provide manufacturer's standard warranty. Materials shall be free from defects in material and workmanship for a period of:
  - 1. Roof Hatch: Five years.
  - 2. Ladder Extension: Five years.
  - 3. Roof Hatch Rail System: Five years.

#### PART 2 - PRODUCTS

##### 2.1 ROOF HATCHES

- A. Roof Hatches: Provide single leaf roof hatches, 2'-6" x 3'-0", of 11 gage aluminum with 22 gauge galvanized/galvannealed steel liner. Product/manufacturer; one of the following:
  - Model No. BRHt; Babcock-Davis Hatchways Inc.
  - Type S-50TB; The Bilco Co.
  - Model ThermalPro 24; Milcor Limited Partnership
  - Model No. RHT; Nystrom.
- B. Construction:
  - 1. Hatch shall be factory assembled with heavy pintle hinges, compression spring operators, positive snap latch with turn handles, padlock hasps and neoprene draft seals.
  - 2. Curb shall be 12" high with 3½" flanges, fully welded at corners and equipped with integral metal cap flashing.
  - 3. Cover shall be insulated with concealed 1" thick fiberglass insulation.
  - 4. Curb shall be insulated with 1" thick fiberboard insulation. Fiberglass insulation is not acceptable.
  - 5. Cover shall have an automatic hold-open arm with red vinyl grip handle. All hardware shall be cadmium plated.

##### 2.2 LADDER EXTENSION

- A. Basis of Design: Provide ladder extension Model LU-2, "LadderUP" Safety post as manufactured by The Bilco Company.
  - 1. 42" high telescoping extension.
  - 2. Post shall lock automatically when fully extended. Release lever shall disengage the post to allow it to be returned to its lowered position.
  - 3. Adjustable mounting brackets shall fit ladder rung spacing and clamp brackets shall accommodate ladder rungs.

4. Balancing Spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lower the safety post.
5. Hardware: All mounting hardware shall be Type 316 stainless steel.
6. Finish: Factory finish of post shall be hot dipped galvanized steel.

## 2.3 ROOF HATCH RAIL SYSTEM

- A. Basis of Design: Where noted on drawings, provide Bil-Guard roof hatch rail system Model RL2-S as manufactured by The Bilco Company.
  1. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.29 and shall meet OSHA strength requirements with a factor of safety of two.
  2. Posts and rails shall be 1¼" schedule 40 pipe in 6061 T6 aluminum alloy.
  3. Hardware shall be Corrosion resistant construction. Locking mechanism is cast aluminum and spring hinges and all fasteners are type 316 stainless steel.
  4. Curb mounting brackets and teardrop brackets are 6063 T5 aluminum extrusion. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.
  5. Self-closing gate.
  6. Color: Safety yellow.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Verify that ladder safety post or hatch rail system installations will not disrupt other trades.
- B. Verify that the ladder rungs are dry, clean, and free of foreign matter.
- C. Report and correct defects prior to any installation.

### 3.2 INSTALLATION

- A. Roof Hatch: Install roof hatches in accordance with the manufacturer's recommendations. Securely fasten to the roof deck with bolts or screws.
- B. Roof Hatch Railing System: Hatch rail system shall attach to the cap flashing of the roof hatch and shall not penetrate any roofing material.
- C. Installer shall field check conditions and verify the manufacturer's ladder safety post and hatch rail system details for accuracy to fit the application prior to fabrication.
- D. Installer shall comply with the ladder safety post and hatch rail system manufacturer's installation instructions.
- E. The manufacturer shall furnish fasteners necessary for installations.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Firestopping for all fire-rated construction complete, including, but not limited to:
  - 1. Firestopping in conjunction with gypsum board, masonry and plaster partitions.
  - 2. Firestopping shall include, but not be limited to the following applications:
    - a. Sealing gaps between tops of partitions and roof/floor decks.
    - b. Sealing gaps between structure and glass curtainwalls with fire safing insulation.
    - c. Other locations where "firestopping", "firestop", or "safing" is indicated.
    - d. Where required by codes.
    - e. Control joints and expansion joints in masonry or gypsum board fire-rated partitions.
    - f. Expansion joints in roof and floor assemblies.
- B. Related Sections:
  - 1. Section 04 20 00 - Masonry Units.
  - 2. Section 07 21 00 - Building Insulation.
  - 3. Section 07 92 00 - Joint Sealants.
  - 4. Section 09 21 13 - Plaster Assemblies.
  - 5. Section 09 21 16 - Gypsum Board Assemblies.
  - 6. Divisions 23 and 26.

1.2 SUBMITTALS

- A. Refer to SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit copies of manufacturer's literature. Include data substantiating that materials comply with specified tested system requirements.
- C. Samples: Submit duplicate samples of each type of firestopping material and accessories.
- D. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgement derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow requirements set forth by the International Firestop Council.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Do not allow firestopping materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection.

1.4 PROJECT CONDITIONS

- A. Do not install firestopping materials until building is completely enclosed and weathertight.
- B. Coordinate installation with the work of other trades. Reference SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

PART 2 - PRODUCTS

2.1 PRODUCT/MATERIAL PERFORMANCE REQUIREMENTS

- A. Except as otherwise indicated, firestop materials shall be classified in the Underwriters Laboratories (UL) Building Materials Directory, "Section XHEZ-Through-Penetration Firestop Systems", and/or "Section XHHW-Fill Void or Cavity Materials", and "Section XHBN - Joint Systems" for specific project conditions:
  - 1. Time rating ("F", Fire and "T", Temperature) (T-rating is only required for construction joint systems).
  - 2. Floor or wall assembly and material.
  - 3. Penetrating materials/items diameters, or void space.



4. Through opening size.
  5. Annular space between penetration opening and penetrating item.
- B. Firestopping materials shall provide a fire-rating commensurate with the adjacent construction rating.
- C. Firestop materials shall comply with ASTM E 84: Surface Burning Characteristics.
- D. Firestop materials shall have been tested in accordance with ASTM E 814, UL 1479 or UL 2079.
- E. Firestop materials shall be free of asbestos.
- F. Firestop materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.
- G. Obtain firestop products from a single manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Installer must examine substrate and conditions under which firestopping work is to be performed, and notify Contractor in writing of any unsatisfactory conditions.

#### 3.2 INSTALLATION

- A. Install firestopping materials including foaming, packing and accessory materials to fill openings around penetrations in floors and walls, to seal gaps between decks and partitions, gaps between structure and curtainwall, etc., to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Use silicone based materials for all wet or damp conditions.
- B. Install firestop materials and systems in accordance with manufacturer's printed instructions and applicable UL Building Materials Directory assemblies.
- C. Cut and friction fit fire safing type insulation firestopping to completely fill all gaps and voids. Provide stick-clips, sheet metal closures, and any other accessories to support insulation.
- D. Where floor openings are 4" or more in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
- E. Remove damming materials after curing if made of other than fire resistant materials.
- F. Protect materials from damage on surfaces subject to traffic.

#### 3.3 FIELD TESTING

- A. Firestop materials and installation shall be tested by an independent testing laboratory. Refer to SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.
- B. Where deficiencies are found or penetration and joint firestopping systems are damaged or removed due to testing, repair or replace penetration and joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing penetration and joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

#### 3.4 CLEAN UP

- A. Clean up all debris caused by the work of this Section, keeping the premises clean and neat at all times.
- B. Clean adjacent surfaces soiled by the work of this section.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sealing and caulking of joints.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete.
  - 2. Section 04 20 00 - Masonry Units.
  - 3. Section 07 62 00 - Sheet Metal Flashing and Trim.
  - 4. Section 07 84 00 - Firestopping.
  - 5. Section 08 80 00 - Glazing.
  - 6. Section 09 21 16 - Gypsum Board Assemblies.

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 1/4" diameter x 4" in size illustrating color selections available.
- D. Submit manufacturer's certificate under provisions of SECTION 01 45 00 - QUALITY CONTROL that products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.
- B. Applicator: Company specializing in applying the work of this section with minimum 3 years documented experience and approved by sealant manufacturer.
- C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.4 FIELD SAMPLES

- A. Provide samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Construct one field sample joint, 5 feet long, illustrating sealant type, color, and tooled surface.
- C. Locate where directed.
- D. Accepted sample may remain as part of the work.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements: No caulking shall be done at temperatures below 40°F.

1.6 WARRANTY

- A. Furnish to the Owner a written warranty that the sealants shall remain watertight for a period of 2 years from the date of acceptance of the building. Joints which prove defective by leaking, cracking, melting or shrinking of the sealant shall be re-sealed without additional expense to the Owner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Reference "SEALANT SCHEDULE" at end of this specification section for locations of Sealant Types.
- B. Modified Polyurethane (Type 1 Sealant):
  - 1. Two or three-part conforming to ASTM C 920, Type M, Grade NS, Class 25.
  - 2. Color: Custom colors as selected by Architect.
  - 3. Acceptable products:
    - MasterSeal NP2, Master Builders Solutions, a brand of MBCC Group.
    - Dymeric 240FC, Tremco.
- C. Pourable Urethane (Type 2 Sealant):
  - 1. Multicomponent conforming to ASTM C 920, Type M, Grade P (pourable), Class 25, Use T (traffic).
  - 2. Color: Custom color as selected by Architect.
  - 3. Acceptable products:
    - Urexpan NR-200, Pecora Corp.
    - MasterSeal SL 2 Sealant; Master Builders Solutions, a brand of MBCC Group.
    - THC 900 (Self leveling) or 901 (low sag), Tremco.
- D. Pourable Urethane Sealant (Type 3 Sealant):
  - 1. Single-component conforming to ASTM C 920, Type S, Grade P (pourable), Class 25, Use T (traffic).
  - 2. Color: Gray or limestone as selected by Architect.
  - 3. Acceptable products:
    - Sikaflex - 1CSL; Sika Corporation, Inc.
    - MasterSeal SL 1; Master Builders Solutions, a brand of MBCC Group.
    - Vulkem 45; Tremco
- E. Silicone, General Purpose (Type 4 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. Polyurethane Hybrid, Paintable (Type 5 Sealant):
  - 1. One-part, moisture-cure, polyurethane hybrid sealant for interior use, conforming to ASTM C 920, Type S, Grade NS, Class 35 and Fed. Spec TT-S-00230C, Class A, Type II.
  - 2. Acceptable product:
    - Dymonic FC, Tremco
- G. Acrylic Latex (Type 6 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.
- H. Acoustical Sealant (Type 7 Sealant):
  - 1. Acrylic Latex Acoustical sealant for concealed locations.
  - 2. Acceptable products:
    - AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
    - Acoustical Sealant, Tremco
    - Sheetrock Acoustical Sealant; USG Co.

### 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 1/4" 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 1/8" 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 1/2 the joint width, but never less than 1/4" 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.

<u>SEALANT TYPE</u>	<u>APPLICATION</u>
1	<ul style="list-style-type: none"> <li>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.</li> <li>b. Vertical joints at perimeter of window, door, and storefront elements where adjacent to stone, masonry, or concrete surfaces.</li> <li>c. Reglets: The top groove along the surface-mounted flashing reglets.</li> <li>d. Sealing joints in sheet metal fabrications.</li> <li>e. Unless noted otherwise, any other exterior vertical joints.</li> </ul>
2	<ul style="list-style-type: none"> <li>a. Interior horizontal control and expansion joints in flooring, stone, masonry and tile flooring and at junctures between these materials and other adjacent materials.</li> </ul>
3	<ul style="list-style-type: none"> <li>a. Exterior horizontal control and expansion joints in concrete paving.</li> <li>b. Filling of roof penetration pockets (pitch pans).</li> </ul>
4	<ul style="list-style-type: none"> <li>a. Sealing of joints between plumbing fixtures and substrates and between plastic laminate splashes and adjacent tops and walls.</li> <li>b. Threshold and windowsills set in full bed of sealant.</li> </ul>
5	<ul style="list-style-type: none"> <li>a. General caulking as part of interior painting in joints subject to movement.</li> <li>b. Sealing of joints between tilt-wall panels.</li> </ul>
6	<ul style="list-style-type: none"> <li>a. General caulking as part of interior painting.</li> </ul>
7	<ul style="list-style-type: none"> <li>a. Setting sill track, head track, and end studs to substrates on acoustically rated partitions. Refer to SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES for application requirements.</li> </ul>

END OF SECTION

SECTION 07 95 00

EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Expansion joint assemblies for floor, wall and ceiling surfaces.
  - 2. Preformed, foam joint seals.
  - 3. Preformed, rubber joint seals.
- B. Related Sections:
  - 1. Section 03 11 00 - Concrete Forming and Accessories: Expansion and contraction joints in exterior concrete joints.
  - 2. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof control joints.
  - 3. Section 07 92 00 - Joint Sealants: Expansion and control joints.

1.2 SUBMITTALS

- A. General: Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Provide joint assembly profiles, dimensions, locations in the Work, affected adjacent construction, anchorage devices, available colors and finish, and locations of splices. Provide Manufacturer's Installation Instructions. Indicate rough-in sizes.
- C. Certificates:
  - 1. Expansion Joint Covers: Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements indicated.
  - 2. Preformed Joint Seals: Tests performed by manufacturer and witnessed by a qualified testing agency for each preformed joint seal.
  - 3. Warranties: Submit warranty information.
- D. Samples:
  - 1. Preformed Joint Seal:
    - a. Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.
    - b. Verification: For each type and color of preformed joint seal required, provide samples with joint seals in 2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint seals.
  - 2. Expansion Joint Covers: Submit two 4" long samples, illustrating profile, dimension, color, and finish selected.
- E. Templates: For cast-in or placed frames or anchors and indicate tolerances for item placement.
- F. Preformed Joint Seal Schedule: Include the following information:
  - 1. Joint seal location and designation.
  - 2. Joint width and movement capability.
  - 3. Joint seal manufacturer and product name.
  - 4. Joint seal color.

1.3 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by the manufacturer.

#### 1.4 WARRANTY

A. Preformed Joint Seal:

1. Special Warranty: Installer agrees to repair or replace preformed joint seals that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - a. Warranty Period: Two years from date of Substantial Completion.
2. Special Manufacturer's Warranty: Manufacturer agrees to furnish preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - a. Warranty Period: Five years from date of Substantial Completion.

#### 1.5 EXTRA MATERIALS

- A. Furnish under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES, AND MAINTENANCE MATERIALS.
- B. Provide 25% overage of resilient joint filler, and special tools required for servicing components.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Expansion Joint Covers: Factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as detailed and as required to provide continuous expansion joint cover assemblies in floors, walls, and ceilings including corners formed by intersections of walls and walls, walls and floors, and walls and ceilings.
1. Basis-of-design Products for each architectural joint system is based on products by Construction Specialties, Inc. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
    - Architectural Art Mfg. Inc.
    - Balco Metalines, Div. of Balco, Inc.
    - MM Systems Corp.
- B. Preformed, Foam Joint Seals (PJS-1): Manufacturer's standard joint seal manufactured with a primary silicone surface seal factory applied to a secondary closed-cell copolymer ethylene vinyl acetate foam rubber seal. Can accommodate miters and changes in direction with heat weldable transitions. Resistant to UV, ozone, acid rain, most chemicals and extreme temperatures. Meets all applicable standards for compressible sealants. Provide MM Systems Corp. ColorJoint (SCE Series) Siesmic Colorseal, or subject to compliance with requirements, comparable products by one of the following:
  - EMSEAL Joint Systems, Ltd.
  - MM Systems Corporation.
  - Nystrom, Inc.
1. Design Criteria:
    - a. Nominal Joint Width: As indicated on Drawings.
    - b. Tensile Strength 115 psi (+25/-0) D3575
    - c. Ultimate Elongation 225% D3575
    - d. Tear Resistance 20 lbs/in  $\pm$  25% D624
    - e. Water Absorption (by weight) <.02 lbs/sq.ft. D3575
    - f. Density Average 2.7 - 3.2 lbs/cu.ft. D3575
    - g. Movement Capability: -25 percent/+25 percent.
  2. Joint Seal Color: As selected by Architect from full range of industry colors.
  3. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.
- C. Preformed, Rubber Joint Seals (PJS-2): The expansion joint shall be a continuous low stress multi-web elastoprene compression seal that remains in compression throughout its entire movement cycle. It shall be bonded in place with polyurethane adhesive creating a watertight seal. The rubber seal design shall be bonded in place with polyurethane adhesive creating a watertight seal. The seal shall be supplied in the longest continuous length possible.
1. Basis of Design Product: Provide MM Systems Corp. Vertical Compression Seal (VCS Series), or subject to compliance with requirements, comparable products by one of the following:
    - MM Systems Corporation
    - Nystrom, Inc.
  2. Design Criteria:
    - a. Nominal Joint Width: As indicated on Drawings.

- |                        |                            |       |
|------------------------|----------------------------|-------|
| b. Tensile Strength    | 1000 psi (+75/-0)          | D412  |
| c. Ultimate Elongation | 445%                       | D412  |
| d. Hardness, Shore A   | 65 +/- 3 pts.              | D2240 |
| e. Tear Strength       | 140 pli / 24.5 kN/m @ 23°C | D624  |
|                        | 58 pli / 10.2 kN/m @100°C  | D624  |
| f. Compression set     |                            |       |
| 168 hrs.               | 25% @ 23°C                 | D395  |
| 168 hrs.               | 38% @ 100°C                | D395  |
| g. Ozone Resistance    | No Cracks                  | D1149 |
| h. UV Resistance       | Very Good                  |       |
| i. Brittle Point       | -76°F                      | D746  |
3. Joint Seal Color: As selected by Architect from full range of industry colors.
4. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.

D. Substitutions: In accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

## 2.2 MATERIALS

- A. Extruded Aluminum: ANSI/ASTM B 221 6063-T5 alloy for extrusions; ASTM B 308 Alloy 6061-T6, for sheet and plate.
- B. Resilient Filler: Extruded vinyl exhibiting Shore 'A' hardness of 40 - 65 Durometer.
- C. Threaded Fasteners: Stainless steel.
- D. Primer: Manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials, or provide bituminous paint, impregnated paper or felt, or an alkali-resistant insulating coating.
- E. Fire Rated Systems: Fire barrier caulk (SECTION 07 84 00 - FIRESTOPPING), fire blanket, and insulation.
- F. Exterior Building Expansion Joint in Masonry Veneer: Provide Compression Seal Expansion Joint Model VCS-225 as manufactured by MM Systems

## 2.3 FABRICATION

- A. All Metal Joint Covers: Aluminum frame construction, free of gaskets and fillers, designed to permit plus or minus 50% joint movement with full recovery, recess mounted.
- B. Concealed aluminum surfaces in direct contact with masonry and concrete shall be shop coated with Manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials, or provide bituminous paint, impregnated paper or felt, or an alkali-resistant insulating coating..
- C. Galvanize embedded ferrous metal anchors and fastening devices.
- D. Shop assemble components and package with anchors and fittings.
- E. Provide joint components in single length wherever practical. Minimize site splicing.

## 2.4 FINISHES

- A. Floors: Mill finish.
- B. Walls and Ceilings: Clear anodized.
- C. Resilient Filler Exposed to View: Color as selected by Architect from standard colors.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify surfaces are ready to receive the materials of this section.



- B. Verify that joint preparation and affected dimensions are acceptable.
- C. Preformed, Foam Joint Seals: Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide anchoring devices for installation.
- B. Provide templates and rough-in measurements.
- C. Preformed, Foam Joint Seals
  - 1. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
    - a. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
    - b. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      - 1) Concrete.
      - 2) Masonry.
      - 3) Unglazed surfaces of ceramic tile.
    - c. Remove laitance and form-release agents from concrete.
    - d. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:
      - 1) Metal.
      - 2) Glass.
      - 3) Porcelain enamel.
      - 4) Glazed surfaces of ceramic tile.
  - 2. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.
  - 3. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor components to substrate to prevent misalignment.
- D. Install fire-rated systems where required.
- E. Installation of Preformed, Foam Joint Seals:
  - 1. Install each length of seal immediately after removing protective wrapping.
  - 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
  - 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
  - 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

F. Installation of Preformed, Rubber Joint Seals:

1. Remove and repair all unsound substrate. Joint opening sidewall interface areas must be clean and dry prior to installation.
2. Prepare joint opening - surfaces must be sound, dry, by sandblasting free laitance, curing agents or foreign matter.
3. Uncoil seal and allow it to relax in the sun for as long as possible before installation.
4. Joint opening must be blown with compressed air immediately prior to seal installation.
5. Clean and prepare sidewalls of the seal and joint opening interface per the installation guidelines.
6. Apply a thin layer of the polyurethane lubricant adhesive to the sides of the seal (enough to fill the ribs) and to the sidewalls of the expansion joint opening.
7. Install the seal by pushing it into the joint opening with a blunt/flat metal bar.
8. Position seal according to dimensional guidelines.
9. Clean excess adhesive from seal and concrete.

3.4 PROTECTION OF FINISHED WORK

- A. Protect finished work under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Do not permit traffic over unprotected floor joint surfaces.
- C. Provide removable coating to protect finish surface.

END OF SECTION

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SECTION 08 11 00

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Hollow metal doors and frames, sidelight frames, and borrowed light frames.
- B. Related Sections:
  - 1. Section 08 14 23 - Plastic-laminate-faced Wood Doors.
  - 2. Section 08 71 00 - Door Hardware: hardware locations.
  - 3. Section 08 80 00 - Glazing: glass for doors, sidelights, and borrowed lights.
  - 4. Section 09 91 00 - Painting: finishing of hollow metal doors and frames.

1.2 SUBMITTALS

- A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
  - 1. Include door sizes, construction, frame types, wall anchors, and accessories required for installation.

1.3 REGULATORY REQUIREMENTS

- A. Conform to applicable local building codes for fire rated requirements of metal door/metal frame and wood door/metal frame assemblies.
- B. Fire Rated Door Construction: Conform to NFPA 252 or UL 10C.

1.4 QUALITY ASSURANCE

- A. Standard: Provide steel doors and frames complying with the Steel Door Institute ANSI/SDI A250.8 and as herein specified. Hollow metal provider that is not a member of the Steel Door Institute is not approved and must submit product data and samples for review.
- B. Fire-Rated Door Assemblies: Provide door and frame assemblies which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL. Metal UL classification markers shall be attached to these doors and frames.
  - 1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- C. Conform to requirements of ANSI/SDI A250.8.
- D. Installed frame and door assembly to conform to UL 10C for fire-rated class indicated or scheduled.
- E. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver metal doors and frames to the project site with no dents or open seams and store upright in a protected dry area. Provide packaging and wrapping to protect hollow metal items.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide steel doors and frames as manufactured by one of the following:
- Ceco Door Products; an ASSA ABLOY Group Co.
  - Curries Company; an ASSA ABLOY Group Co.
  - Deansteel Mfg., Inc.
  - Mesker Door, Inc.
  - Republic Builders Products Co.
  - Steelcraft; an Allegion Co.

### 2.2 MATERIALS

- A. Sheet and Strip: ASTM A 1008, commercial quality, leveled, cold-rolled steel free of scale and other surface defects.

### 2.3 FABRICATION

- A. Flush Steel Doors: Full flush type of welded seamless construction with no visible seams or joints on faces or vertical edges.
1. Exterior Doors:
    - a. Extra Heavy Duty; 0.053" thick metallic-coated steel sheet faces (16 ga.); SDI A250.8 Level 3; SDI A250.4 Performance Level A; Edge Construction Model 2 Seamless.
    - b. Provide foamed-in-place polyurethane insulation with minimum U-factor of 0.60 for assembly with frame.
    - c. Steel reinforced, stiffened and sound-deadened by laminating insulation completely filling the door and formed steel vertical stiffeners spaced 6" o.c. and attached to face sheets by spot welds and with the spaces between stiffeners filled with insulation material.
    - d. Face: Metallic-coated steel sheet, with minimum A60 coating.
  2. Interior Doors:
    - a. Heavy Duty; 0.042" thick uncoated steel sheet faces (18 ga.); SDI A250.8 Level 2; SDI A250.4 Performance Level B; Edge Construction Model 2 Seamless.
    - b. Steel reinforced, stiffened and sound-deadened by laminating to small cell impregnated kraft honeycomb core completely filling the door.
  3. Fire Rated Doors: Provide mineral fiberboard core as scheduled and/or as required to meet applicable codes.
  4. Steel thickness is thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
  5. Continuous vertical interlocking joints on lock and hinge edges with seams continuously welded, filled and dressed smooth. Bevel vertical edges.
  6. Top and bottom edges closed with continuous recessed steel channels spot welded to both faces. Top edge of exterior doors sealed flush with closing channel to exclude water.
  7. Fixed glass moldings welded to security side of door. Loose moldings of 20 gage steel fastened with countersunk flat head screws. Fabricate stops to receive vinyl gaskets.
  8. Overlapping steel astragals for pairs of labeled doors as required by manufacturer to meet codes.
  9. Louvers at non-fire-rated doors: Provide factory installed, inverted "V" or "Y" sightproof type fixed louvers. Louver blades shall be 18 gage and frame shall be 18 gage welded construction.
  10. Louvers at 20-minute, B-, and C- label fire rated doors: Provide factory installed louvers with fusible link closure for use at fire-rated locations, all-welded construction, size as indicated on drawings.
- B. Stile and Rail Doors: Provide tubular stile and rail construction, 1-3/4" thick and fabricated from 16 gage cold-rolled steel.
1. Stiles shall extend the full height of the doors. Rails shall be mechanically joined to the stiles forming a neat seam on the face.
  2. Continuous vertical interlocking joints on lock and hinge edges with seams continuously welded, filled and dressed smooth. Bevel vertical edges.
  3. Top and bottom edges closed with continuous recessed steel channels spot welded to both faces.
  4. Fixed glass moldings welded to security side of door. Loose moldings of 20 gage steel fastened with countersunk flathead screws. Fabricate stops to receive vinyl gaskets.

- C. Steel Frames: Combination buck, frame and trim type. Provide frames with face width, throat opening, backbend, and jamb depth as per dimensions shown.
1. Exterior Frames:
    - a. Extra Heavy Duty; 0.067" thick metallic-coated steel sheet (14 ga.); SDI A250.8 Level 3; SDI A250.4 Performance Level A.
    - b. Continuously welded (full profile welded).
    - c. Minimum U-factor of 0.60 for assembly with door.
    - d. Metallic-coated steel sheet with minimum A60 coating.
  2. Interior Frames:
    - a. Heavy Duty; 0.053" thick uncoated steel sheet (16 ga.); SDI A250.8 Level 3; SDI A250.4 Performance Level B.
    - b. Continuously welded (full profile welded).
  3. Brake-form to profile free of warp, buckles, and fractures with corners square and sharp. Form stop integral with frame except where detailed otherwise. Dress sheared edges straight and smooth.
  4. Close corner joints tight with trim faces mitered and continuously welded. Dress exposed welds flush and smooth.
  5. Fabricate frames for large openings in knocked-down sections for field assembly with butt joints and internal reinforcing sleeves. Knocked-down frame assemblies shall be trial assembled in the shop.
  6. Loose glazing stops shall be 16 gage steel, mitered corners, fastened with countersunk flathead screws. Fabricate stops to receive vinyl gaskets.
  7. Weld 14 gage steel floor anchors inside each jamb with two holes each anchor for floor anchor bolts.
  8. Furnish frames with steel spreader temporarily fastened to the feet of both jambs for rigidity during shipping and handling.
  9. For each jamb in masonry construction provide 3 or more 16 gage adjustable jamb anchors of the T-strap type spaced not more than 30" apart. Furnish yoke type Underwriters anchors for labeled door openings only.
  10. For each jamb in steel stud construction provide 4 or more 18 gage drywall type jamb anchors. Weld anchors inside each jamb and wire or bolt to the studs.
- D. Shop Finish: After fabrication, doors and frames shall be degreased, phosphatized, and factory painted inside and out with a rust inhibitive synthetic primer. Apply mineral filler to eliminate weld scars and other blemishes.
- E. Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- F. Reinforce frames wider than 48" with roll formed steel channels fitted tightly into frame head, flush with top.
- G. Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.
- H. Attach fire-rated label to each frame and door unit.
- I. Close top edge of exterior door flush with inverted steel channel closure. Seal joints watertight.
- J. Fabricate frames for masonry wall coursing with 2" head member.

## 2.4 HARDWARE PREPARATION

- A. Prepare doors and door frames for hardware. Mortising, reinforcing, drilling, and tapping shall be done at the factory for mortised hardware. Reinforcement shall be provided for surface-applied hardware, and the drilling and tapping for this hardware shall be done in the field. Provide plaster guards for hinge and strike reinforcements and cutouts on frames.
- B. Reinforcement plates in doors and frames for hardware shall be 7 gage for hinges and 12 gage for all other hardware.
- C. Punch for and install rubber silencers on all interior hollow metal door frames. Furnish 3 silencers for each single door and 2 silencers for each pair of doors. Set out and adjust strikes to provide clearance for the silencers. Omit silencers on exterior door frames.

## 2.5 CLEARANCES

- A. Doors shall have pre-fit clearances of:
  - 1. At Head and Lock Stile: 1/8".
  - 2. At Hinge Stile: 1/16".
  - 3. At Door Sill:
    - a. Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
    - b. With Threshold: 1/8" from bottom of door to top of threshold.
  - 4. Between meeting edges of pair of doors: 1/8".
- B. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80. Bevel fire-rated doors 1/8" in 2" in lock edge.

## 2.6 ACCESSORIES

- A. Rubber Silencers: Resilient rubber.
- B. Anchors: Three per jamb, typically, of type to suit supportive construction.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

### 3.2 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.
- C. Install fire-rated frames and place fire-rated doors in accordance with NFPA 80.
- D. Coordinate with masonry and wallboard construction for anchor placement.
- E. Coordinate installation of glass and glazing.
- F. Install doors accurately in frames, maintaining specified clearances.
- G. Setting Frames:
  - 1. Check frames for rack, twist and out-of-square, and correct.
  - 2. Set frames accurately to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.
  - 3. Anchor frames securely to adjacent construction. Anchor to floor at each jamb with two bolts to prevent twist.
  - 4. Leave spreader bars in place until frames have been permanently built into the walls.
  - 5. Install fire-rated frames in accordance with NFPA 80.
- H. Hanging Doors:
  - 1. Fit and hang the doors to maintain specified door clearances. Metal hinge shims are acceptable to maintain clearances.
  - 2. Doors shall be out of wind and shall operate smoothly and quietly after adjustment.
  - 3. Place fire-rated doors with clearances as specified in NFPA 80.

### 3.3 TOLERANCES

- A. Maximum Diagonal Distortion: 1/8" measured with straight edge, corner to corner.

END OF SECTION



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SECTION 08 14 23

PLASTIC-LAMINATE-FACED WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Solid core plastic-faced wood doors [and transom panels].
  - 2. Fire-rated plastic-faced wood doors [and transom panels].
- B. Related Sections:
  - 1. Section 06 40 00 - Architectural Woodwork: laminate clad cabinets.
  - 2. Section 08 11 00 - Hollow Metal Doors and Frames: hollow metal frames.
  - 3. Section 08 71 00 - Door Hardware: location of hardware.
  - 4. Section 08 80 00 - Glazing: glass for doors.
  - 5. Section 10 21 14 - Plastic Laminate Toilet Compartments.
  - 6. Section 12 32 16 - Manufactured Plastic-laminate-clad Casework

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Indicate sizes, construction, core materials, edge banding dimensions and stop profile.
- C. Product Data: Indicate door core materials and construction; type and characteristics.
- D. Samples:
  - 1. Submit a sample, 6" by 6", of each plastic laminate finish and color selected.
  - 2. Submit a 12" x 12" sample of solid core door panel indicating construction, core, face and edge detail.
  - 3. Submit 8-1/2" x 11" paint color samples of door glazing frame paint.
- E. Certificates: Submit certification that doors comply with reference standards fabrication requirements, signed by authorized representative of door manufacturer.

1.3 QUALITY ASSURANCE

- A. Standard: Comply with the requirements of "Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program" as published by Architectural Woodwork Institute.
- B. Fire-Rated Wood Doors: Provide plastic faced wood doors which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL or Warnock Hersey. Provide metal UL or Warnock Hersey classification markers attached to door.
  - 1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- C. Color Uniformity: Provide plastic laminate for laminate clad millwork, casework, plastic faced wood doors, and plastic laminate toilet compartments from the same manufacturer.
- D. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.4 REGULATORY REQUIREMENTS

- A. Fire Door Construction: Conform to NFPA 252.
- B. Installed Fire-Rated Door Assembly: Conform to NFPA 80 for fire-rated class as scheduled.

## 1.5 DELIVERY

- A. Deliver doors to the project site ready for installation and to receive hardware. Each unit shall be individually plastic wrapped at the factory for protection in transit and storage.

## 1.6 WARRANTY

- A. Special Warranty: Provide Life-of-Installation warranty on manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section. Warranty shall specifically include installation of replacement doors required during term of the warranty.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide plastic laminate faced wood doors as manufactured by one of the following:
  - Marshfield-Algoma (Masonite Architectural)
  - Oregon Door
  - VT Industries, Inc./Eggers Industries, Architectural Door Div.

### 2.2 MATERIALS AND FABRICATION

- A. Flush Doors: Premium Grade, PC-HPDL-3 (3-ply), as defined in Section 9 of AWI Quality Standards.
  - 1. Core: Particleboard meeting ANSI A 208.1, Grade LD-2, Urea-Formaldehyde Free.
  - 2. Stiles: Vertical edges at least 1-1/8" and bonded to core. Species shall be closed grain hardwood with factory-painted finish to match faces. At doors with wood-look plastic laminate faces, stain vertical edges to match faces.
  - 3. Rails: Top and bottom rail edges at least 1-1/8" and bonded to core. Mill option.
  - 4. Faces: HGS (nominal 0.048") high pressure decorative laminated plastic conforming to NEMA LD 3. Laminate to be bonded to both faces. Fire-rated plastic laminate faced wood doors shall be surfaced with fire-rated (UL Stamped) laminated plastic sheet. Color shall be as selected by Architect from manufacturer's full color and pattern range. Product/manufacturer; one of the following:
    - Formica Brand Laminate; Formica Corp.
    - Pionite or Nevamar; Panolam Industries
    - Wilsonart; Wilsonart LLC
  - 5. Stops: Provide shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.
  - 6. Louvers at non-fire-rated doors: Provide factory installed, inverted "V" or "Y" sightproof type fixed louvers. Furnish with standard factory baked enamel finish.
  - 7. Louvers at 20 minute-, B-, and C-label doors: Provide factory installed louvers with fusible link closure for use at fire-rated locations, all-welded construction, size as indicated on drawings.
- B. Labeled Doors:
  - 1. "B" Label Doors (90-minute and 60-minute): AWI Type FD 1-1/2 or 1 non-combustible solid mineral core with chemically treated hardwood edge banding and fire-retardant cross banding. Pairs of "B Label" doors shall be furnished with necessary metal edge and astragal trim if required by door manufacturer to meet code requirements.
  - 2. "C" Label Doors: AWI Type FD 3/4 non-combustible solid mineral core with chemically treated hardwood edge banding and fire-retardant cross banding.
  - 3. 20-Minute Label Doors: AWI Type FD 1/3 solid particleboard core with a 20-Minute Fire Label.
  - 4. Smoke Control Door Labeling: Smoke control doors shall show the letter "S" on the fire rating label of the door. The marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.
  - 5. Cut-outs for vision panels in fire-rated doors shall be factory cut. No field cutting shall be permitted.
  - 6. Stops: Provide listed shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.
- C. Fitting:
  - 1. Cutouts for mortise hardware shall be made to template at the factory.
  - 2. Top and bottom rail edges and core exposed by cutouts for hardware shall be factory sealed.
  - 3. Doors shall have pre-fit clearances of:
    - a. At Head and Lock Stile: 1/8"

- b. At Hinge Stile: 1/16"
  - c. At Door Sill:
    - 1) Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
    - 2) With Threshold: 1/8" from bottom of door to top of threshold.
  - d. Between meeting edges of pair of doors: 1/8"
4. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80. Bevel fire-rated doors 1/8" in 2" in lock edge.

## 2.3 ADHESIVE

- A. Facing Adhesive: Type I - waterproof.

## 2.4 FABRICATION

- A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.
- B. Fabricate fire-rated doors in accordance with AWI Quality Standards and to UL or Warnock-Hersey requirements. Attach fire-rating label to door.
- C. Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.
- D. Fit door metal edge trim to edge of stiles after applying veneer facing.
- E. Bond edge banding to cores.
- F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through-bolted hardware.
- G. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify frame opening conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### 3.2 PREPARATION

- A. Condition plastic faced wood doors to the average prevailing humidity in the building prior to fitting and hanging.

### 3.3 INSTALLATION

- A. General: Installation of doors shall comply with the applicable requirements of Section 1700 Installation of Architectural Woodwork (Interior) of the AWI Quality Standards.
- B. Hang doors to maintain uniform clearances. Doors shall be out of wind and shall operate smoothly and quietly after adjustment. Replace doors damaged during installation.
- C. Cutting and fitting of plastic laminate faced doors at the project site will not be permitted. Doors which do not fit properly shall be replaced.
- D. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80. Trim stiles and rails of fire-rated doors only to extent permitted by labeling agency.
- E. Pilot drill screw and bolt holes.

- F. Machine cut for hardware. Core for handsets and cylinders.
- G. Coordinate installation of doors with installation of frames specified in SECTION 08 11 00 - HOLLOW METAL DOORS AND FRAMES and hardware specified in SECTION 08 71 00 - DOOR HARDWARE.
- H. Coordinate installation of glass and glazing.

### 3.4 INSTALLATION TOLERANCES

- A. Conform to AWI requirements for fit and clearance tolerances.
- B. Maximum Diagonal Distortion (Warp): 1/8" measured with straight edge or taut string, corner to corner, over an imaginary 36" x 84" surface area.
- C. Maximum Vertical Distortion (Bow): 1/8" measured with straight edge or taut string, top to bottom, over an imaginary 36" x 84" surface area.
- D. Maximum Width Distortion (Cup): 1/8" measured with straight edge or taut string, edge to edge, over an imaginary 36" x 84" surface area.

### 3.5 ADJUSTING

- A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.
- B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Wall and ceiling access doors.
- B. Related Sections
  - 1. Section 04 20 00 - Masonry Units: Openings in masonry.
  - 2. Section 09 21 16 - Gypsum Board Assemblies: Openings in gypsum board walls and ceilings.
  - 3. Section 09 30 13 - Ceramic Tiling.
  - 4. Section 09 91 00 - Painting: Field paint finish.
  - 5. Division 22 - Plumbing components requiring access.
  - 6. Division 23 - Mechanical components requiring access.
  - 7. Division 26 - Electrical components requiring access.

1.2 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with UL requirements for fire-rated doors.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire-rated access units.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by the manufacturer.

1.6 COORDINATION

- A. Coordinate work under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
- B. Coordinate the work with mechanical and electrical work requiring access units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide wall and ceiling access doors as manufactured by one of the following:
  - J.L. Industries, Inc.
  - Karp Associates, Inc.
  - Larsen's Mfg. Co.
  - Milcor Limited Partnership
  - Nystrom Building Products Co.

2.2 GENERAL

- A. Flush metal panel access doors.
- B. Size: As required for ease of access, but not less than 12" x 12".
- C. Material:
  - 1. Model M3202: Painted steel 14 gauge frame and door.

2. Model MS3202: Stainless steel 16 gauge frame and door.
3. Models DW3203 and K3200: Painted steel 16 gauge frame; 14 gauge door.
4. Model ATR3204: Painted steel 16 gauge frame; 18 gauge door.
5. Fire-Rated Model 3218: Painted and stainless steel 14 gauge frame; 20 gauge door.

D. Lock: Screwdriver operated, with metal cam.

## 2.3 ACCESS UNITS - WALLS

### A. Non-Fire-Rated Door and Frame Unit:

1. In Cast-in-Place Concrete: Model M3202 (painted) manufactured by Milcor.
2. In Masonry: Model M3202 (painted) manufactured by Milcor.
3. In Ceramic Tile on Gypsum Board on Steel Studs: Model MS3202 (stainless steel) manufactured by Milcor.
4. In Gypsum Board on Steel Studs: Model DW3203 (painted) manufactured by Milcor.
5. In Plaster on Metal Furring: Model K3200 (painted) manufactured by Milcor.

### B. Fire-Rated Door and Frame Unit: 1-1/2-hour UL B label fire rating

1. In Cast-in-Place Concrete: Model 3218 (painted) manufactured by Milcor.
2. In Masonry: Model 3218 (painted) manufactured by Milcor.
3. In Ceramic Tile on Gypsum Board on Steel Studs: Model 3218 (stainless steel) manufactured by Milcor.
4. In Gypsum Board on Steel Studs: Model 3218 (painted) manufactured by Milcor.
5. In Plaster on Metal Furring: Model 3218 manufactured by Milcor.

## 2.4 ACCESS UNITS - CEILINGS

### A. Non-Fire-Rated Door and Frame Unit:

1. In Gypsum Board on Metal Furring: Model DW 3203 manufactured by Milcor.
2. In Plaster on Metal Furring: Model K3200 manufactured by Milcor.
3. In Metal T-Bar Ceiling: Model ATR 3204 manufactured by Milcor.

### B. Fire-Rated Door and Frame Unit: 1-1/2-hour UL B label fire rating

1. In Gypsum Board on Metal Furring: Model 3218 manufactured by Milcor.
2. In Plaster on Metal Furring: Model 3218 manufactured by Milcor.

## 2.5 FINISHES

A. Painted Finish: One coat baked enamel primer with baked enamel finish, color as selected by Architect.

B. Stainless Steel: No. 4 finish.

C. Aluminum: Mill finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that rough openings for door and frame are correctly sized and located.

### 3.2 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Position unit to provide convenient access to concealed work requiring access.

END OF SECTION

SECTION 08 34 73

SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sound control door assemblies consisting of swinging steel doors, frames, cam-lift hinges, and sound seals.
  - 1. Where scheduled, provide sound control doors listed and labeled to meet fire ratings indicated.
- B. Related Sections:
  - 1. Section 08 71 00 - Door Hardware; locksets, exit devices, and closers.
  - 2. Section 08 80 00 - Glazing.
  - 3. Section 09 91 00 - Painting

1.2 PERFORMANCE REQUIREMENTS

- A. Sound Rating: Provide door and frame assemblies that have been fabricated as sound-retardant units, tested according to ASTM E 90, and have the following certified STC rating according to ASTM E 413:
  - 1. Reference STC Ratings on Door Schedule in Drawings

1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Include door sizes, construction, glazing requirements, frame types, wall anchors, and accessories required for installation, and interface of the work of this section with the work of adjacent trades.
- C. Test Reports:
  - 1. Submit acoustical test reports from an independent acoustical laboratory indicating door, glazing, and frame assemblies of the same construction as those specified for this project have been tested in accordance with ASTM E 90 and meet the STC rating indicated in accordance with ASTM E 413.
  - 2. Laboratory referenced in the certification must be qualified under the National Voluntary Laboratory Accreditation Program (NAVLAB) of the U.S. Bureau of Standards.
  - 3. Certification must reference laboratory name, test report number, and date of test.

1.4 QUALITY ASSURANCE

- A. Fire-Rated Door Assemblies: Provide door and frame assemblies which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL. Metal UL classification markers shall be attached to these doors and frames.
  - 1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- B. Installer Qualifications: Manufacturer's authorized representative with a minimum of 5 years successful experience and who is trained and approved for installation of units required for this project.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver sound control metal door and frame assemblies to the project site with no dents or open seams and store upright in a protected dry area. Provide packaging and wrapping to protect hollow metal items.



## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Materials and methods described are based on the specifications of **Overly Manufacturing Company** and are given to designate the quality of materials and workmanship required. Equivalent sound control door and frame assemblies as manufactured by one of the following will be acceptable:

Ambico Limited  
Krieger Steel Products Company  
Security Metal Products Co. (Assa Abloy)

### 2.2 MATERIALS

- A. Sheet and Strip: ASTM A 1008, commercial quality, leveled, cold-rolled steel free of scale and other surface defects.
- B. Supports and Anchors: Fabricate from not less than 0.053-inch thick sheet metal.
- C. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints on steel surfaces.
- D. Cam-Lift Hinges: Manufacturer's standard heavy-duty cam-lift hinges.
- E. Vision Light Glazing:
1. Wire Glass: ASTM C 1036, Type II, Class 1 (Clear), Form 1 (Wired, polished both sides), Quality q8 (Glazing), Mesh m2 (Square), 1/4" thickness.
  2. Laminated Glass: Two panes of Class 1 (Clear) float glass (ASTM C 1036) of equal thickness, laminated together with not less than 0.030" thick clear polyvinyl butyl plastic interlayer to provide an overall thickness of 3/8". Fabricate laminated glass using laminator's standard heat-plus-pressure process to produce glass free from foreign substances and air/glass pockets.

### 2.3 FABRICATION

- A. Door Construction:
1. Acoustical doors shall be 1 3/4" thick, constructed of 16 gage minimum steel face sheets jointed on the vertical edges and packed with a non-coupling acoustical core. The hinge edge of the door shall have a chamfered edge.
  2. Glazing: Provide all cutouts and loose/fixed stops to facilitate double glazing as required by manufacturer to meet STC rating indicated. Provide glass assembly recommended in writing by door manufacturer.
- B. Door frames shall be fabricated from 14 gage steel with corners mitered continuously welded and ground smooth. Hinge reinforcement plates shall be not less than 3/16" thick steel welded in place. Hinge reinforcements shall be not less than 10 gage steel.
- C. Noise Control Seals:
1. Head and jamb seals shall be magnetic or neoprene compression seal, in a fully adjustable retainer assembly, as required to meet STC rating indicated.
  2. Door bottom seal shall be fully mortised, automatic type and adjustable, with an extruded neoprene insert full width of door.
  3. Pairs of doors shall be provided with neoprene compression astragals as needed to meet the STC rating indicated.
- D. Shop Finish: After fabrication, doors and frames shall be degreased, phosphatized, and factory painted inside and out with a rust inhibitive synthetic primer. Apply mineral filler to eliminate weld scars and other blemishes.

## 2.4 HARDWARE PREPARATION

- A. Prepare doors and door frames for hardware. Mortising, reinforcing, drilling, and tapping shall be done at the factory for mortised hardware. Reinforcement shall be provided for surface-applied hardware, and drilling and tapping for this hardware shall be done in the field.
  - 1. Provide manufacturer's standard Z- or L-brackets for mounting door closers, to ensure continuity of compression sound seals.
- B. Locations of hardware on doors and frames shall comply with the requirements of SECTION 08 71 00 - DOOR HARDWARE.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Setting Frames:
  - 1. Check frames for rack, twist and out-of-square, and correct.
  - 2. Set frames accurately to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.
  - 3. Anchor frames securely to adjacent construction. Anchor to floor at each jamb with two bolts to prevent twist.
  - 4. Leave spreader bars in place until frames have been permanently built into the walls.
- B. Hanging Doors:
  - 1. Fit and hang the doors to maintain required door clearances.
  - 2. Doors shall not be warped, bowed, or cupped.
  - 3. Doors shall be plumb and shall operate smoothly and quietly after adjustment.
  - 4. Adjust noise control seals to maintain contact with door and achieve STC rating indicated.
- C. Install doors accurately in accordance with manufacturer's written instructions, with the following clearances:
  - 1. 1/8" at jamb.
  - 2. 3/16" at head (cam-lift hinges)
  - 3. 1/8" at leading edge of pairs.
  - 4. Manufacturer's standard at bottom.

END OF SECTION

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SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Aluminum entrance and storefront systems with associated aluminum doors.
- B. Related Sections:
  - 1. Section 07 92 00 - Joint Sealants: caulking of perimeter joints.
  - 2. Section 08 44 13 - Glazed Aluminum Curtain Walls
  - 3. Section 08 71 00 - Door Hardware; hardware for aluminum doors.
  - 4. Section 08 80 00 - Glazing.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Include drawings showing elevations of each entrance and storefront type, detail sections of typical composite members, and glazing details.
- C. Samples: Submit for approval duplicate samples showing the limits of color range to which the entrance, storefront, and door materials will be processed. Samples shall be representative of the materials to be furnished, and the color of the installed materials shall be within the range of the approved samples.
- D. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

1.3 SYSTEM DESCRIPTION AND PERFORMANCE

- A. Architectural Requirements
  - 1. Drawings are diagrammatic and do not purport to identify or solve problems of thermal or structural movement, glazing or anchorage.
  - 2. Requirements shown by details are intended to establish basic dimensions of units, sightlines and profiles of members.
  - 3. Provide concealed fastening wherever possible.
  - 4. Provide continuous snap-in thermally-broken aluminum backer plate at head and jamb conditions.
- B. Structural Requirements
  - 1. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170°F. without causing detrimental effects to system or components.
  - 2. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ANSI/ASTM E 330.
  - 3. Limit mullion deflection to L/175, or flexure limit of glass with full recovery of glazing materials, whichever is less.
  - 4. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
  - 5. Storefront manufacturer shall be responsible for design and engineering of storefront system, including necessary modifications to meet specified requirements and maintaining visual design concepts.
  - 6. Attachment considerations shall take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
  - 7. Design anchors, fasteners and braces to be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
  - 8. Engineer storefront and entrances to be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

C. Environmental Requirements

1. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior. No leakage shall occur in wall when tested in accordance with ASTM E 331 at test pressure of 6.24 lbs/sq ft.
2. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of assembly surface area, measured at a reference differential pressure across assembly of 1.57 lbs/sq ft. as measured in accordance with ANSI/ASTM E 283.
3. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

1.4 QUALITY ASSURANCE

- A. Erector Qualifications: Erection of the entrance and storefront systems and doors shall be by an experienced erector approved by the manufacturer.
- B. Design Criteria:
1. Deflection of glass framing members under design loads shall not exceed  $L/175$  or  $\frac{3}{4}$ ", whichever is less.
  2. Deadload deflection of horizontal glass framing members shall not exceed 0.125".
  3. Exterior Entrances and Storefront: Design windload shall be 22 psf.
- C. Perform work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and handle system components under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.
- B. Store and protect system components under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- C. Provide wrapping to protect prefinished aluminum surfaces.

1.6 COORDINATION

- A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings required field measurements beyond his control.
- B. Coordinate with responsible trades to establish, verify and maintain field dimensions and job conditions.

1.7 ENVIRONMENTAL CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40°F. during and 48-hours after installation.

1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water leakage through fixed glazing and framing areas.
    - e. Failure or operating components to function properly.
  2. Warranty Period: 2 years from date of substantial completion.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide aluminum entrances and storefronts as manufactured by one of the following:
  - EFCO Corp.
  - Kawneer North America
  - Oldcastle Building Envelope
  - Tubelite, Inc
  - YKK AP America, Inc.
- B. Aluminum Panel Spandrel: Provide Provide GlazeGuard WR 1000 by Citadel Architectural Products, Inc. (phone 800.446.8828; website: [www.citadelap.com](http://www.citadelap.com)) 1" thick smooth aluminum-faced panel constructed of aluminum skins laminated to 5/32" thick high density polypropylene stabilizers either side of a 5/8" thick polyisocyanurate foam core.
  - 1. Face Sheet Thickness: 0.024".
  - 2. Back Sheet Thickness: 0.024".
  - 3. Finish: Anodized finish to match storefront and entrances.

### 2.2 MATERIALS

- A. Extruded Aluminum: ASTM B 221; AA 6063-T5 alloy, temper.
- B. Sheet Aluminum: ASTM B 209; 5005-H34 alloy, temper; or other alloys and temper recommend by manufacturer appropriate for specified finish.
- C. Sheet Steel: ASTM A 446; hot-dipped galvanized.
- D. Steel Sections: ASTM A 36; shapes to suit mullion sections.
- E. Primer and Touch-Up Primer for Galvanized Surfaces: High-zinc-dust-content paint complying with SSPC-Paint 20.
- F. Fasteners: Stainless steel.

### 2.3 FABRICATED COMPONENTS

- A. General: Form section true to details with clean, straight, sharply defined profiles, free from defects impairing strength or durability.
- B. Framing:
  - 1. Framing Types Basis of Design shall be Kawneer:
    - a. Exterior: Provide the following thermally broken framing systems where shown on drawings.
      - 1) 2" x 6" Framing System: Kawneer Trifab™ 601T
      - 2) 2" x 4-1/2" Framing System: Kawneer Trifab® VG™ 451T
    - b. Interior: Provide the following framing systems where shown on drawings.
      - 1) 1-3/4" x 4-1/2" Framing System: Kawneer Trifab® VG 450
      - 2) 2" x 4-1/2" Framing System: Kawneer Trifab® VG™ 450
  - 2. Fabricate the aluminum entrance and storefront systems with the shapes and sections detailed.
  - 3. Design the glass framing system to minimize loads on the glass due to building movement and incorporate provisions for thermal expansion by means of expansion joints. Where insulating glass is to be installed, design the glass framing system so that moisture does not accumulate in the glazing channel for prolonged periods.
  - 4. Construction: Mill joints to a hairline fit. Assemble and connect members to form rigid, watertight assemblies. No exposed fastenings will be permitted. Reinforce the framing internally as required to meet the design criteria specified above.
  - 5. Continuous Solid Closures: Fabricate required closures and covers to detail of aluminum sheet, plate, and angles. Provide solid continuous thermally-broken backer plate closures at head and all jambs.
  - 6. Accessories: Provide glazing gaskets, flashing, and miscellaneous shims and other parts detailed or otherwise required to complete the work.
  - 7. Provide solid aluminum head channel at head condition as shown by drawings.

- C. Doors: Kawneer 500 Heavy Wall Doors and Heavy Wall Framing System. The aluminum doors shall be wide-stile type with 5" stiles, 6-1/2" top rail, 5" intermediate rail (centered on panic device) and 10 1/4" bottom rail; square glazing stops. Construction: Doors shall be mortised and have reinforced welded corner construction with hairline watertight joints. Fastenings shall be concealed.
  - 1. Doors shall be factory fabricated by aluminum entrance and storefront manufacturer.
  - 2. Glazing Beads: Fixed or theft proof snap-in glazing beads on exterior or security side of doors. Interior glazing beads shall be snap-in type. All glazing beads shall have vinyl inserts and glazing gaskets.
  - 3. Weatherstripping: Continuous contact weatherstripping on stiles and top rails of exterior doors.
- D. Ticket Window: Provide anodized aluminum and #304-#3 finish stainless steel ticket windows as manufactured by Quikserv, Inc. (phone 866.739.1540 website: [www.quikserv.com](http://www.quikserv.com)).
  - 1. Provide Model TI-3036, insulated glazing ticket window, 30"W x 36"H, rough opening 30-3/8"W x 36-3/8"H.
    - a. Includes 8-1/2" x 11" deal tray in stainless steel base with stainless steel flip lid.
    - b. Includes speak-thru.
    - c. Finish shall be clear anodized.
- E. Hardware Preparation: Prepare and reinforce doors and door frames for hardware.
  - 1. Mortising, reinforcing, drilling, and tapping for mortised hardware shall be done at the factory.
  - 2. Wherever possible, concealed steel reinforcement for surface-applied hardware shall be installed at the factory. The drilling and tapping for surface-applied hardware shall be done in the field.
- F. Reinforced Mullion: Same profile as non-reinforced frames, of extruded aluminum cladding with internal reinforcement of steel shaped structural section.
- G. Flashings:
  - 1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oilcanning"; of proper alloy to match the finished extrusions.
  - 2. Subsill Flashing: Provide manufacturer's standard high-performance, thermally-broken aluminum subsill flashing with integral weep holes. End dams shall be manufacturer's standard fiberglass, plastic or thermally-broken aluminum end dams.
- H. Extruded Aluminum:
  - 1. Framing System: Principal extrusions shall have a minimum wall thickness of 0.08". Moldings, trim, and glass stops shall be not less than 0.050" thick.
  - 2. Doors and Door Framing System: Principal extrusions shall have a minimum wall thickness of 3/16". Moldings, trim, and glass stops shall be not less than 0.050" thick.
- I. Reinforcement: Concealed reinforcements for hardware in doors and frames and mullions shall be plated or galvanized steel and shall be secured in place. If Heavy Wall doors \*\*\*OR\*\*\* Monumental doors are not specified, then provide continuous reinforcement at continuous geared hinges.
- J. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.
- K. Rigidly fit and secure joints and corners with internal reinforcement, except that door corners will be welded. Make joints and connections flush, hairline, and weatherproof.
- L. Develop drainage holes with moisture pattern to exterior.
- M. Prepare components to receive anchor devices. Fabricate anchorage items.
- N. Arrange fasteners, attachments, and jointing to ensure concealment from view.
- O. Prepare components with internal reinforcement for door hardware.
- P. Reinforce framing members for imposed loads.

## 2.4 HARDWARE

- A. Weatherstripping: Provide Kawneer's Polymeric Sealair Weathering System or approved equivalent, continuous at head, jamb, sill, and meeting stile.

- B. Speak Hole: Provide Model 834A speak hole with appropriate screw length for 1/2" glass, 4-1/4" hole dia, 5-5/16" full diameter. Satin Anodized Speak-Thru as manufactured by C.R.Laurence Co., Inc.
- C. Refer to SECTION 08 71 00 - DOOR HARDWARE for balance of hardware.

## 2.5 FINISHES

- A. Finish coating to conform to AAMA 611. Finish for aluminum entrances, storefronts, frames, doors and spandrel panels shall match.
- B. Aluminum Finish: Exposed aluminum surfaces of entrances, storefronts, frames, doors, and spandrel panels, and all their associated parts shall be Architectural Class I AA-M10C22A41 Clear Anodic Coating, .7 mil minimum. Screw and bolt heads exposed to view shall be finished to match the exposed aluminum surfaces.
- C. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A 123 to 2.0 oz/sq ft.
- D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive entrances and storefronts for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.
- B. Field check dimensions, elevations, and slopes on the connecting work affecting the entrance and storefront to assure a proper fit and weathertight installation.
- C. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

### 3.2 INSTALLATION

- A. Install wall system, doors, and glazing in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window.
- B. Erecting Storefronts: Erect the members to be plumb, level, square and in proper alignment with other work, and free from sags, waves and buckles.
  - 1. Materials shall be accurately cut and fitted and rigidly anchored in place to resist safely all normal stresses to which the work will be subjected.
  - 2. Cut and machined ends and recesses shall be true, accurate and free of burrs and rough edges.
  - 3. Provide subsill extrusions positioned to collect water leakage through mullions and storefront. Subsill shall drain to the exterior. It shall run continuously across the opening width. The ends are sealed with end dams.
  - 4. Create end dams at ends of window heads, sills, at edges of storefronts, and other vertical elements to channel water to nearest weep hole away from window mullions and other items which might allow water to travel vertically.
  - 5. Provide clearance around the perimeter between entrance and storefront metal and the opening substrate (concrete, masonry, or stucco) for caulking.
- C. Hanging Doors: Fit the doors with hardware and hang to operate smoothly, without bind or chatter.
  - 1. Where concealed reinforcement for hardware cannot be provided, install and use Riv-Nuts for fastening surface applied hardware.
  - 2. Use sex bolts and nuts for fastening closers and closer arms to aluminum doors.
  - 3. The use of sheet metal or self-tapping screws to mount hardware is prohibited.
- D. Sealing Joints: Seal the metal-to-metal framing joints properly in conformance with the manufacturer's standard procedure.
- E. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.



- F. Install hardware using templates provided. Refer to SECTION 08 71 00 - DOOR HARDWARE for installation requirements.
- G. Install glass and infill panels in accordance with SECTION 08 80 00 - GLAZING, using exterior dry method of glazing.
- H. Install perimeter 2-part polyurethane type sealant, backing materials, and installation requirements in accordance with SECTION 07 92 00 - JOINT SEALANTS.

### 3.3 TOLERANCES

- A. Maximum Variation from Plumb: 0.06" every 3' non-cumulative or 1/16" per 10', whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32".

### 3.4 ADJUSTING

- A. Adjust operating hardware for smooth operation.

### 3.5 PROTECT AND CLEAN

- A. Protection of Aluminum:
  - 1. Protect concealed aluminum surfaces that will contact masonry, concrete and steel with neoprene gaskets or a coat of bituminous paint to prevent galvanic and corrosive action.
  - 2. If drainage of moisture from incompatible metal passes over aluminum, paint the incompatible metal with a coat of aluminum pigmented paint.
  - 3. Protect finished aluminum surfaces from staining by gypsum and cement materials until all adjacent masonry and plaster work has been completed.
- B. Cleaning: Upon completion of the work, wash down aluminum surfaces with water and soft cloths and leave in first class condition.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 08 Section "Door Hardware Schedule".
  - 2. Division 08 Section "Hollow Metal Doors and Frames".
  - 3. Division 08 Section "Interior Aluminum Doors and Frames".
  - 4. Division 08 Section "Plastic Laminate Faced Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series
  - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified installer of Windstorm assemblies.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  - 3. Review sequence of operation narratives for each unique access controlled opening.
  - 4. Review and finalize construction schedule and verify availability of materials.
  - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Lifetime for mortise locks and latches.
  - 2. Five years for exit hardware.
  - 3. Ten years for electric latch retraction exit motors
  - 4. Twenty-five years for manual surface door closer bodies.
  - 5. Two years for electromechanical door hardware.
  - 6. Lifetime for SN200 readers.

#### 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

#### 1.9 OWNER STOCK – See Attic Stock at the end of Hardware Schedule.

### PART 2 - PRODUCTS

#### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

### A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
  - a. Two Hinges: For doors with heights up to 60 inches.
  - b. Three Hinges: For doors with heights 61 to 90 inches.
  - c. Four Hinges: For doors with heights 91 to 120 inches.
  - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
  - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
  - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
  - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
  - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Acceptable Manufacturers:
  - a. Hager Companies (HA).
  - b. McKinney Products (MK).
  - c. Stanley Hardware (ST).

### B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Acceptable Manufacturers:
  - a. McKinney Products (MK).
  - b. Pemko Manufacturing (PE).
  - c. Stanley Hardware (ST).

## 2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Acceptable Manufacturers:
- Pemko Manufacturing (PE) – EL-CEPT Series.
  - Securitron (SU) - EL-CEPT Series.
  - Stanley Hardware (ST) EPT-12C Series.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
- McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
  - McKinney Products (MK) - Connector Hand Tool: QC-R003.

## 2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
- Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
  - Furnish dust proof strikes for bottom bolts.
  - Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  - Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  - Acceptable Manufacturers:
    - Ives (IV).
    - Rockwood Manufacturing (RO).
    - Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
- Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  - Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  - Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  - Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.



5. Acceptable Manufacturers:

- a. Ives (IV).
- b. Rockwood Manufacturing (RO).
- c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
  1. Acceptable Manufacturers:
    - a. Stanley Best (BE).
    - b. Sargent Cylinder Housings
    - c. No Substitution.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Match Facility Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
  1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. Existing System: Key locks to Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
  1. Change Keys per Cylinder: Two (2)
  2. Twenty construction cores
  3. 50 Key Blanks – Best "A" Keyway
- F. Construction Keying: Provide temporary keyed construction cores. Green Best Cores No Substitution . All Best temporary cores to be returned to the district at the end of the project.
- G. Key Registration List (Bitting List):
  1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

- H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project. Provide a new cabinet to all new construction projects. Use Lund 1205-B as a basis of design.

1. Acceptable Manufacturers:

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Acceptable Manufacturers

- a. Sargent Manufacturing (SA) 8200 Series – No substitutions
- b. Sargent Manufacturing (SA) 10X Series - No substitutions
- 1) Use at student restrooms or as directed by Cy Fair ISD

2.7 AUXILIARY LOCKS

- A. Tubular Deadlocks: Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Acceptable Manufacturers:

- a. Marks (MX) - 130 Series.
- b. Sargent Manufacturing (SA) – 480 Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

- B. Standards: Comply with the following:

- 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
- 2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
- 3. Dustproof Strikes: BHMA A156.16.

## 2.9 CONVENTIONAL EXIT DEVICES

### A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
  - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
  - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
6. Rail Sizing: Provide exit device rails factory sized for proper door width application.
7. Through Bolt Installation: For exit devices and trim as indicated (TB) in Door Hardware Sets.
8. Provide Less Dogging (LD) at all exit devices.
9. Add 31- Prefix to all exit devices being provided at two inch aluminum doors.
10. No self-tapping screws allowed.

### B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:
  - a. Sargent Manufacturing (SA) - 80 Series.
  - b. No Substitution.

### C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.
2. Provide stabilizers and mounting brackets as required.
3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Acceptable Manufacturers:

- a. Stanley Precision (PR) - 822 Series.
- b. No Substitution.

2.10 INTEGRATED WIEGAND OUTPUT ACCESS CONTROL EXIT DEVICES

- A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
3. 12VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader is always 12VDC). 24VDC required for solenoid operated exit trim (12VDC if applicable). Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.

5. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) - SN – 56-SN20080 Series Exits. x SPAR04867
- b. Sargent Manufacturing (SA) - SN – SN2008200 Series Locks.
- c. No Substitution.

2.11 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt and security type fasteners as required for proper installation.
8. Through Bolt Installation: All door closers are to be installed with (TB) through bolting as indicated in Door Hardware Sets.
9. No self-tapping screws allowed.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:
  - a. Sargent Manufacturing (SA) – TB 351 Series.

## 2.12 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Acceptable Manufacturers:
  - a. LCN Door Closers (LC) - SEM7800 Series.
  - b. Rixson (RF) - 980/990 Series.
  - c. Sargent Manufacturing (SA) - 1560 Series.

## 2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, .050-inch thick.
4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

5. Acceptable Manufacturers:

- a. Ives (IV).
- b. Rockwood Manufacturing (RO).
- c. Trimco (TC).

2.14 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

- a. Ives (IV).
- b. Rockwood Manufacturing (RO).
- c. Trimco (TC).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

- a. Do not use overhead stops/holders

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. No Replaceable Seal Strips allowed: Provide only those units where they can be screw applied..

E. Acceptable Manufacturers:

1. National Guard Products (NG).
2. Pemko Manufacturing (PE).
3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:

- a. Provided by Security

- B. Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single, dual, or multi-voltage units as shown in the hardware sets. Units must be expandable up to eight Class 2 power limited outputs. Units must include the capability to incorporate a battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

- a. Provided by Security

2.17 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program.
- D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.
- G. No self-tapping screws allowed.



### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
- B. Final Adjustment: Installer shall return and make final adjustment of all hardware once all air conditioning test and balance is complete. Final adjustment shall be made while air conditioner system is operating. Coordinate with General Contractor and Owner.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- A. Manufacturer's Abbreviations:

- 1. MK - McKinney
- 2. OT - OTHER
- 3. PE - Pemko
- 4. RO - Rockwood
- 5. PR - Precision
- 6. MX - Marks
- 7. SA - Sargent
- 8. AD - Adams Rite
- 9. BE - Best Access Systems

- 10. HS – HES
- 11. SU – Securitron
- 12. KD – Keedex
- 13. LO – Locinox

**\*\*At existing doors / frames, all conditions must be field verified prior to order.**

**At aluminum frames, gasket is by frame manufacturer.**

**\*\*Add 2891APK gasketing to all exterior hollow metal doors.**

### **Hardware Sets**

#### **Set: 1.0**

Doors: 1000B.1, 1000B.2, 1001, 1018.1, 25

Description: Add Reader

1	SN200 Reader	52 6027 (Exit / Lock)	26D	SA
1	Balance of hardware	Existing to remain		OT

Notes: Keep ES at 23.

#### **Set: 2.0**

Doors: 1212.3, 1214.1, 1226.2, 1228, 1247.2, 1255.2, 1257.1, 1442.3, 1613.1, 1613A.1, 1619.2, 1619A.1, 1621.2, 1644.2, 1672.1, 1710B, 1720.1, 1720.4, 1726.2, 1736.1, 1754.1, 1756.1, 1758.2, 1830.1, 1910.2, 1910B.1, 2212.1, 2214.2, 2226.3, 2228.1, 2247.2, 2255.3, 2257.3, 2311.1, 2313.3, 2315.2, 2422.2, 2440, 2440C, 2450.1, 2451.1, 2612.2, 2613, 2614.1, 2616.1, S11.2

Description: Add Exit Device-8816- HO Closers

1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

#### **Set: 3.0**

Doors: 1212.2, 1214.2, 1226.1, 1228.2, 1247.1, 1255.1, 1257.2, 1442.2, 1613A.2, 1613A.3, 1720.3, 1720.6, 1736.2, 1754.2, 1758.1, 1830.2, 1910.1, 2212.2, 2214.1, 2226.1, 2228.3, 2247.3, 2255.1, 2257.2, 2311.3, 2313.2, 2315.3, 2422.1, 2440A, 2440B, 2450.2, 2451.2, 2612.1, 2614.2, 2616.2

Description: Add Exit Device-8804- HO Closers

1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**Set: 4.0**

Doors: 1720.2, 1720.5, 1720.7, 1720.8, 1720.9, 1721.10, 1721.11, 1721.12, 1721.4, 1721.5, 1721.6  
Description: Add Exit Device-8810 ETL

1	Rim Exit - DT x SPAR#NC-E11	19 LD TB 43 8810 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**Set: 5.0**

Doors: 1630  
Description: Add Exit Device-8816/8804- HO Closers - Thru bolts

1	Rim Exit Sec CR x SPAR#NC-E11	LD 19 LD 43 49 70 8816 ETL	US32D	SA
1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
3	Interchangeable Core	I/CK-7	626	BE
3	Const. Core	7190224	Green	BE
2	Sex Nut & Bolt Kit	SNB134-38	689	NO
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

\*\*TB Kit to be used to fill existing pull preps.

**Set: 6.0**

Doors: 1000C.3, 1613.2, 1700.1, 1700.2, 1700.3, 1700.4, 1901A.1, 1901B.2, 1901C, 2815.1, 2815.2  
Description: Add Exit Device-8816/8804- HO Closers

1	Rim Exit Sec CR x SPAR#NC-E11	LD 19 LD 43 49 70 8816 ETL	US32D	SA
1	Rim Exit NL SPAR#NC-E11	LD 19 43 70 8804 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
3	Interchangeable Core	I/CK-7	626	BE
3	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PSH	EN	SA
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**Set: 7.0**

Doors: 1646, 1648  
Description: Add Exit Device-8813- 688

1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
1	Rim Exit Classroom SPAR#NC-E11	LD 19 TB 43 70 8813 ETL	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**Set: 8.0**

Doors: 1000C.2, 1600.1

Description: Add Exit Device-8813/8813- HO Closers

1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
2	Rim Exit Classroom SPAR#NC-E11	LD 19 TB 43 70 8813 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PSH	EN	SA
2	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Provide hold open closers at classrooms unless fire rated. No hold open on rated doors.

**Set: 9.0**

Doors: 1800.1, 1800.5

Description: Add Rated Exit Device-8813/8813- 688 Retrofit Kit

2	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
2	Rim Exit Classroom SPAR#NC-E11	LD 19 TB 43 70 8813 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

**Set: 10.0**

Doors: 2315, S1.1, S1.2, S13.1, S13.2, S14.1, S14.2, S2.1, S2.2, S3.1, S3.2, S4.1, S4.2, S5.1, S5.2, S5.3, S6.1, S6.2, S8.1, S8.2, S9.1, S9.2

Description: Add Rated Exit Device-8815/8815- 688 Retrofit Kit

2	Rim Exit Device, Passage	12 19 TB 43 8815 ETL	US32D	SA
2	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
1	Balance of hardware	Existing to remain		OT

**Set: 11.0**

Doors: 2619

Description: Add Rated Exit Device-8815

1	Rim Exit Device, Passage	12 19 TB 43 8815 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
1	Balance of hardware	Existing to remain		OT

**Set: 12.0**

Doors: 36

Description: Add Ext Exit Device-8804 FSW

1	Rim Exit x SPAR#NC-E11	LD 19 TB 43 70 8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Balance of hardware	Existing to remain		OT

Notes:

**Set: 13.0**

Doors: 15, 16, 22.1, 31, 33, 35, 39, 40, 41, 42

Description: Add SN200 Narrow Exit, Less Trim EPT

1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit xSPAR04867/NC-E11/NC-E35	19 LD TB 43 70 56-SN200-8504 Less Trim	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

**Set: 14.0**

Doors: 22.2, 22.3

Description: Add 8504Narrow Exit x Less Trim

1	Rim Exit SPAR#NC-E11	LD 19 TB 43 70 8504 Less Trim	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Balance of hardware	Existing to remain		OT

**Set: 15.0**

Doors: 1.1, 1000A.2, 14.2, 6

Description: Add Pr 8504/8510 Narrow Exit x Less Trim

1	Rim Exit SPAR NC-E11	LD 19 TB 43 8510 EO	US32D	SA
1	Rim Exit SPAR#NC-E11	LD 19 TB 43 70 8504 Less Trim	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	Balance of hardware	Existing to remain		OT

**Set: 16.0**

Doors: 5

Description: Add Pr SN200 Narrow Exit x Less Trim - Loop

1	Rim Exit xSPAR04867/NC-E11/NC-E35	19 LD TB 43 70 56-SN200-8504 Less Trim	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing trim.

**Set: 17.0**

Doors: 1,2, 1000A.1, 11, 12, 13, 14.1, 17, 37, 38, 43, 49, 53, 54, 60, 7

Description: Add Pr SN200 Narrow Exit 8504 x 8510, EPT Less Trim

1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit SPAR NC-E11	LD 19 TB 43 8510 EO	US32D	SA
1	Rim Exit xSPAR04867/NC-E11/NC-E35	19 LD TB 43 70 56-SN200-8504 Less Trim	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

**Set: 18.0**

Doors: 18

Description: Add Pr SN200 Narrow Exit 8504 x 8510, Loop Less Trim

1	Rim Exit SPAR NC-E11	LD 19 TB 43 8510 EO	US32D	SA
1	Rim Exit xSPAR04867/NC-E11/NC-E35	19 LD TB 43 70 56-SN200-8504 Less Trim	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Replace HID jamb reader with SN200.

**Set: 19.0**

Doors: 24

Description: Add Ext SN200 Exit ETL, Loop

1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 ETL	US32D	SA
1	Retrofit Kit	688 Kit for 8800 Series Trim	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

**Set: 20.0**

Doors: 20, 21, 28

Description: Add SN200 Exit, Loop - Less Trim

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim.

**Set: 21.0**

Doors: 23, 48

Description: Add Ext SN200 Exit, Loop - FSW

1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim.

**Set: 22.0**

Doors: 3, 4

Description: Add Pr SN200 Exit, Loop

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim.

**Set: 23.0**

Doors: 56

Description: Add Pr EXT SN200 Exit / 8810 - FSW,/FLW Loop

1	Rim Exit SPAR NC-E11	19 TB 43 8810 FLW	US32D	SA
1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

**Set: 24.0**

Doors: 59

Description: Add Pr EXT SN200 / 8810 Exit - Less Trim - EPT

2	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Rim Exit EO x SPAR#NC-E11	19 LD TB 43 8810	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim

**Set: 25.0**

Doors: 46

Description: Add Pr EXT SN200 Exit / 8810 - FSW,/FLW Loop - Peep

1	Rim Exit SPAR NC-E11	19 TB 43 8810 FLW	US32D	SA
1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT
1	Viewer	622 x door thickness	DCRM	RO

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.



**Set: 26.0**

Doors: 34, 55, 57, 58

Description: Add Ext SN200 Lock, Loop

1	SN200 Mort Lock	70 SN200-82271 OL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert

**Set: 27.0**

Doors: 1003, 1004, 1015, 1022A, 1025, 1028, 1030A, 1030B, 1030D, 1035B, 1036, 1040A, 1059, 1066.1, 1066.2, 1101, 1102, 1103, 1110, 1140B, 1151, 1202, 1203, 1212.4, 1214A, 1218, 1218A, 1221, 1226, 1234, 1247B, 1250, 1252, 1253B, 1257A.3, 1265.1, 1265.2, 1286A, 1304, 1307, 13221, 1322B, 1369.8, 1404, 1411, 1412, 1414, 1415, 1416.2, 1421C, 1430A, 1432.2, 1441A, 1443B, 1446B, 1447B, 1500D, 1515B, 1517.1, 1518, 1522B, 1522C, 1533, 1535A, 1545A, 1548D, 1550, 1614D, 1618, 1618A, 1619A.2, 1626, 1628, 1630A, 1632, 1640, 1654.2, 1711B, 1712, 1714, 1720A, 1720B, 1720C, 1721.7, 1721C, 1721D, 1725, 1731, 1731A, 1732D, 1735.2, 1735.3, 1735E, 1736A, 1740.2, 1740.3, 1747, 1750, 1751C, 1751D, 1751G, 1751J, 1751K, 1751L, 1756B, 1766A, 1770, 1770A, 1801, 1805, 1817, 1819, 1820B.1, 1820D, 1822.3, 1830B, 1832, 1834A.5, 1836A, 1836B, 1836D, 1841.9, 1842, 1844A, 1905, 1906, 1910A, 1916A, 1916B, 1920.2, 1921, 1922, 1923, 1925, 1926, 2101, 2102, 2103, 2105, 2106, 2140.2, 2152, 2202, 2203, 2212A, 2214A, 2215.1, 2218A, 2221, 2230, 2234, 2235, 2236, 2244, 2246, 2247B, 2252, 2253.2, 2311.2, 2313.1, 2314A, 2315.1, 2322, 2323, 2324, 2340, 2347, 2348, 2421, 2446, 2515A, 2528A, 2547, 2549, 2612A, 2612B, 2614B, 2616.4, 2709, 2709A, 2710, 2711, 2712, 2714A, 2724, 2724A.1, 2724A.2, 2724B, 2726A, 2726C, 2726D, 2800, 2801, 2801B, 2805A, 2817.1, 2822, 2826, 2901, S11.1, S12.1, S12.2

Description: Existing - Add 8204

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 28.0**

Doors: 1835A, 30, 32

Description: Existing - Add 8204 2891

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Balance of hardware	Existing to remain		OT

**Set: 29.0**

Doors: 2250A

Description: Existing - Add 8204 - HO Closer - Custodian

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 30.0**

Doors: 1018.2, 1061, 1212.1, 1228.1, 1247A.1, 1247A.2, 1255.3, 1257A.1, 1257A.2, 1302.2, 1311.3, 1431A, 1446.2, 1461A, 1517.2, 1545.2, 1621A, 1621B, 1756A.1, 1756A.2, 1756A.3, 1821, 1836M, 1916, 2212.3, 2215, 2226.2, 2228.2, 2247.1, 2255.2, 2257.1, 2450A.1, 2450A.2, 2450A.3, 2450B, 2614A.2, 2614A.3

Description: Existing - Add 8204 - Dummy Cyl

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Cylinder	Dummy Cylinder	US32D	SA
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 31.0**

Doors: 1037

Description: Existing - Add 8204 - Dummy Cyl - Armor Plate

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Cylinder	Dummy Cylinder	US32D	SA
1	Const. Core	7190224	Green	BE
1	Armor Plate	K1050 36" CSK BEV	US32D	RO
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 32.0**

Doors: 1266.2, 1312.3, 1322.2, 1430.2, 1522.1, 1535.1, 1802.1, 1802.2, 1830G.18, 1901, 1901B.1, 2811.1

Description: Existing - Add 8204 - HO Closer - Classroom/Snack

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 33.0**

Doors: 1446.1, 2514

Description: Existing - Add 8238 - Rated Classroom

1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 34.0**

Doors: 1112, 1114, 1116, 1143, 1144, 1145, 1146, 1147, 1154, 1155, 1156, 1157, 1162, 1201, 1213, 1217, 1220, 1222, 1225, 1227, 1231, 1235, 1241, 1244, 1246, 1248, 1251, 1256, 1258, 1261, 1266.1, 1301, 1302.1, 1303, 1311.1, 1312.2, 1315.1, 1322.1, 1323, 1416.1, 1430.1, 1431.1, 1441, 1447.2, 1461, 1462, 1515, 1515A.3, 1519, 1522.3, 1535, 1545.1, 1546, 1548, 1548.1, 1549, 1549.1, 1735, 1735A, 1740A, 1740B, 1741, 1751E, 1751H, 1752, 1758A.1, 1760, 1761, 1762, 1763, 1764, 1766, 1767, 1768, 1820, 1820B, 1834.3, 1901A.3, 1901A.4, 2112, 2114, 2116, 2141.3, 2143, 2144, 2145, 2146, 2147, 2154, 2155, 2157, 2158, 2201, 2213, 2217, 2220, 2222, 2225, 2227, 2231, 2239, 2240, 2241, 2251, 2256, 2258, 2325, 2326, 2327, 2328, 2341, 2342, 2343, 2344, 2345, 2346, 2415, 2416, 2417, 2418, 2419, 2420, 2443, 2447, 2448, 2449, 2512, 2516, 2519, 2543, 2615, 2713.1, 2715, 2716, 2717, 2718.2, 2811.2, 2813, 2821, PB-17, PB-18

Description: Existing - Add 8238 - HO Closer

1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 35.0**

Doors: 1035, 1040.1, 1040.2, 1150, 1305, 1311A, 1313, 1620.1, 1620.2, 1765, 2141.1, 2150, 2151, 2162, 2321, 2412, 2414, 2441, 2517, 2528, 2817, 2823, 2825

Description: Existing - Add 8238

1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 36.0**

Doors: 1063, 1065.1, 1065.2, 1315A.1, 1315A.3, 1315B, 1431.2, 1442A, 1442B, 1443, 1443A, 1447.1, 1461B, 1515A.2, 1515C, 1535B, 1535C, 1535F, 1546B, 1548C, 1622, 1622C, 1741.1, 1830A, 2713A, 2713B, 2713C

Description: Existing - Add 8237 - dummy cylinder

1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Cylinder	Dummy Cylinder	US32D	SA
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 37.0**

Doors: 1018, 1035E, 1051, 1052, 1062, 1064, 1266A, 1311.2, 1312.1, 1369.9, 1431.2, 1432.1, 1446.3, 1522.2, 1522A, 1535E, 1546C.1, 1546C.2, 1546D, 1549.2, 1611.1, 1611A, 1614, 1614A.1, 1614A.2, 1654.1, 1654.3, 1715, 1715C, 1721.3, 1736B, 1737.1, 1741A, 1751A, 1751B, 1758A.3, 1820A, 1835D.3, 1836F, 1836G, 1836H, 1836J.1, 1836J.2, 1836K, 1836L, 1920.1, 2614A.1, 2714

Description: Existing - Add 8237

1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 38.0**

Doors: 1002, 1005, 1010.1, 1010.2, 1010.3, 1013, 1014, 1016, 1019, 1021, 1023, 1041, 1042, 1043, 1044, 1046, 1047, 1048, 1049, 1050, 1140, 1140A, 1140C, 1140D, 1253A, 1253C, 1253D, 1421A, 1421B, 1421D, 1500A, 1500B, 1500C, 1500E, 1732, 1732A, 1732B, 1732C, 1737.2, 1913, 1920A, 2140.1, 2140A, 2140D, 2253A, 2253C, 2253D, 2720

Description: Existing - Add 8205

1	Office/Entry Lock	70 8205 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 39.0**

Doors: 1020, 1022, 1030, 1052A, 1105, 1253.1, 1314, 1421, 1500, 1740.1, 1740E, 2140.3, 2253.1, 2803, 2805

Description: Existing - Add 8205/ Indicator

1	Office/Entry Lock	V01 EMB 70 8205 VN1L	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 40.0**

Doors: 2617

Description: Existing - Add 8205 - HO Closer

1	Office/Entry Lock	70 8205 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 H	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 41.0**

Doors: 1204, 1232, 1243, 1264, 1701, 1702, 1708, 1709, 2204, 2219, 2232, 2238, 2243, 2250

Description: Existing - Add 8250 - HO Closer

1	Hotel Guest Lock Lock	V20 LC 8250 VN1L	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 H	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 42.0**

Doors: 1901A.2, 1901A.5

Description: Existing - Add 8205/ Indicator

1	Office/Entry Lock	V01 EMB 70 8205 VN1L	US26D	SA
1	Dormitory/Exit Lock	V20 70 8225 VN1L	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 43.0**

Doors: 1011, 1012, 1035C, 1035D, 1315C, 1315D, 1447A, 1447C, 1535D, 1546A, 1548A, 1548B, 1614F, 1654B, 1715B, 1844B  
Description: Existing - Add 8265

1	Privacy Lock	V20 8265 VN1L	US26D	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 44.0**

Doors: 1216, 1245, 1820C, 2245  
Description: Existing - Add 10xG37 HO

1	Classroom Lock	70 10XG37 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 45.0**

Doors: 1035A, 1830C, 1830D, 1830E, 1830F, 1836E  
Description: Existing - Add 8215

1	Passage Latch	8215 LL	US26D	SA
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

**Set: 46.0**

Doors: 1242.1  
Description: Existing - Add 8217

1	Asylum/Institutional Lock	70 8217 LL	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Balance of hardware	Existing to remain		OT

Notes: Not to be used where egress is required. Confirm locking arrangement with local authorities.

**Set: 47.0**

Doors: 52, 8

Description: \*\*Pr Ext - ASF - Exit Device- SN200/DT - Mullion - Closer w/Stop Arm -Access Control

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM SLF-HD1 PT x Dr. Ht.		PE
1	Electric Power Transfer	EL-CEPT	630	SU
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Mullion	822 (FL as req)	600	PR
1	Rim Exit xSPAR04867/NC-E11/NC-E35	19 LD TB 43 70 56-SN200-8504 862	US32D	SA
1	Rim Exit x SPAR#NC-E11	19 TB 43 8510 862	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
1	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 P10	EN	SA
2	Drop Plate	351D	EN	SA
2	Door Stop	482	US26D	RO
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	Perimeter Seal	By door mfr		OT
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored. Confirm specified hardware is compatible with aluminum door manufacturer.

**Set: 48.0**

Doors: 47

Description: \*\*Pr Ext - Exit Device- SN200/DT - Mullion - Closer w/Stop Arm -Access Control

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Mullion	822 (FL as req)	600	PR
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Rim Exit EO x SPAR#NC-E11	19 LD TB 43 8810	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Vandal Resistant Trim	821	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
1	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored.

**Set: 49.0**

Doors: 1918, 26, 27

Description: \*\*Pr Ext - Exit Device- SN200/DT FSW- Mullion - Closer w/Stop Arm -Access Control

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Mullion	822 (FL as req)	600	PR
1	Rim Exit SPAR NC-E11	19 TB 43 8810 FLW	US32D	SA
1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
1	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored.

**Set: 50.0**

Doors: 45, 51

Description: \*\*Sgl - ExT -HM - Exit- SN200 FSW - Closer /Stop- Access Control

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Rim Exit x SPAR04867/NC-E11	LD 19 TB 43 70 56-SN200-8804 FSW	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Door Stop	462	US2C	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored. Confirm specified hardware is compatible with door manufacturer.

**Set: 51.0**

Doors: 19

Description: \*\*Sgl - ExT -HM - Exit- SN200 - Closer /Stop- Access Control

1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

**Set: 52.0**

Doors: 1831A

Description: \*\*Pr Ext - Storeroom/Mechanical - Closer/Stop

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Surface Bolt	585-12 @ top only	US26D	RO
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 CPS	EN	SA
1	Astragal Set (2)	18061CNB x Dr. Ht		PE
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
2	Door Position Switch	By Security.		OT

Notes: Closer on active leaf.

**Set: 53.0**

Doors: 1000-F

Description: \*\*Sgl - Ext- Mech/Storage/Fire Riser - Closer w/Stop Arm

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	Door Position Switch	By Security.		OT



**Set: 54.0**

Doors: 1721B.2

Description: \*\*Sgl Typ - Security Classroom - Closer - HO

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ CPSH (outswing) As Req	EN	SA
1	Kit	581-1/ 581-2 as required	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Notes: Provide hold open closers at classrooms.

**Set: 55.0**

Doors: 1242.2

Description: \*\*Pr Int -Vest Exit Device- Sec CR x NL - Mullion - Closer w/HO

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Mullion	822 (FL as req)	600	PR
1	Rim Exit SPAR NC-E11	LD 19 TB 43 70 8804 ETL	US32D	SA
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA
4	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PSH	EN	SA
2	Silencer	608		RO

**Set: 56.0**

Doors: 1831, 1835

Description: \*\*Sgl - Exit Device-Security CL - Closer - STC

3	Hinges	By the STC door manufacturer		OT
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasket, threshold, door bottom	By the STC door manufacturer		OT

**Set: 57.0**

Doors: 1324, 1326, 1700.5

Description: Sgl - Exit Device-Security CL - Closer / HO

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

**Set: 58.0**

Doors: 1836

Description: \*\*Pr - Int Classroom Sec CL x NL -Closer - Armor - CH

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit SPAR NC-E11	LD 19 TB 43 70 8804 ETL	US32D	SA
1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
4	Interchangeable Core	I/CK-7	626	BE
1	Mullion Cylinder	70 34 x 1KB-3	US32D	SA
4	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ CPSH (outswing) As Req	EN	SA
2	Armor Plate	K1050 36" CSK BEV	US32D	RO
2	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Mullion Gasketing	5110BL		PE

Notes:

**Set: 59.0**

Doors: 1000.1

Description: \*\*Sgl- Int ASF- SN200 Lock- Closer - Access Control

1	Continuous Hinge	CFM SLF-HD1 PT x Dr. Ht.		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	SN200 Mort Lock	70 SN200-82271 OL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU
1	Gasketing	By the frame manufacturer		OT

Notes: Operation: Door normally closed and secure. Valid card at the card reader will allow entry by trim. Free egress at all times. Door status is monitored. Install reader and cylinder on reception side.

**Set: 60.0**

Doors: 1325, 1327, 1814, 1835E

Description: \*\*Sgl - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

**Set: 61.0**

Doors: 1847

Description: \*\*Sgl - Storeroom - Wide

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

**Set: 62.0**

Doors: 1813

Description: \*\*Sgl - Storeroom - Closer / HO - Gasket - Janitor

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

**Set: 63.0**

Doors: 1328

Description: \*\*Pr - Storeroom - Floor Stop - Mechanical - No Closer

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Surface Bolt	580-12 @ top only	US26D	RO
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Door Stop	481	US26D	RO
2	Silencer	608		RO

**Set: 64.0**

Doors: 1810

Description: \*\*Sgl - Office, Conf, Work, Sat Admin Offices, Lounge, Nurse - No Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office/Entry Lock	70 8205 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481	US26D	RO
1	Silencer	608		RO

**Set: 65.0**

Doors: 1822

Description: \*\*Sgl CH Pair Typ - Security Classroom - Closer - HO

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Continuous Latch Flush Bolt	2805 /2905	US26D	RO
1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Coordinator	2672	Black	RO
2	Mounting Bracket	2601AB	Black	RO
2	Door Closer w/ HO	TB 351 H (inswing)/ CPSH (outswing) As Req	EN	SA
2	Door Stop	481H	US26D	RO
2	Silencer	608		RO

Notes: Provide hold open closers at classrooms.

**Set: 66.0**

Doors: 1812

Description: \*\*Sgl - Classroom

4	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Kit	581-1/ 581-2 as required	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

**Set: 67.0**

Doors: 1835F, 1835G, 1835H, 1835J

Description: \*\*Sgl - 8204 - Practice STC

3	Hinges	By the STC door manufacturer		OT
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Gasket, threshold, door bottom	By the STC door manufacturer		OT

**Set: 68.0**

Doors: 1837, 1838

Description: \*\*Sgl - Multi Occ RR - Classroom Cyl - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	70 10XG37 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

**Set: 69.0**

Doors: 1811A, 1811B

Description: \*\*Sgl - Typ / 8265 Privacy - Closer - HO

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Privacy Lock	V20 8265 VN1L	US26D	SA
1	Door Closer w/ HO	TB 351 H (inswing)/ CPSH (outswing) As Req	EN	SA
1	Door Stop	481	US26D	RO
3	Silencer	608		RO

**Set: 70.0**

Doors: 1817A, 1817B, 1839

Description: \*\*Sgl - MS / HS Staff RR - Hotel Lock w/Indicator - Closer - Hold\*

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Hotel Guest Lock Lock	V20 LC 8250 VN1L	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ CPSH (outswing) As Req	EN	SA
1	Kit	581-1/ 581-2 as required	EN	SA
1	Door Stop	481	US26D	RO
1	Silencer	608		RO

**Set: 71.0**

Doors: 75, 77, 79, 80, 81

Description: \*\*OH Coiling Doors - No Work

1	All hardware	Existing to remain		OT
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**Set: 72.0**

Doors: 2001-F

Description: \*\*OH Coiling Doors - Motorized

2	Mortise Cylinder	70 42	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
2	Keyswitch	MK x MKS		SU
1	Balance hardware	by the door manufacturer		OT

Notes: Provide keyswitch on both sides of door.

**Set: 73.0**

Doors: 1288.1, 1288.2, 1288.3

Description: \*\*OH Coiling Doors - Manual

1	Mortise Cylinder	70 42	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Balance hardware	by the door manufacturer		OT

Notes: Confirm cylinder type required with door manufacturer.

**Set: 74.0**

Doors: 1022.1, 1022.3, 1315A.2, 1416B, 1622D, 1633, 1636, 1649, 1654A, 1710.1, 1710.2, 1715A, 1716, 1717A, 1721B.1, 1726.1, 1735.1, 1741B, 1751M, 1751N, 1751P, 1751Q, 1751R, 1830G.15, 1910B.2, 1910B.5, 1912, 1912A, 1914, 2216, 2249, C2340

Description: No Work

1	All hardware	Existing to remain	OT
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**Set: 75.0**

Doors: 1815, 1816

Description: By Others

1	All hardware	By the door manufacturer	OT
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**Set: 76.0**

Doors: Attic

Description: \*\*Attic Stock - EVERY CAMPUS

1	Hydraulic Gate Closer & Hinge	MAMMOTH-180-HD	9005	OT
5	Quick Fix Bolts	MAMMOTH-P00006000		OT
5	Classroom Security Escutcheon Kit	IS V01 8238 VN1L RH	US26D	SA
5	Classroom Security Escutcheon Kit	IS V01 8238 VN1L LH	US26D	SA
2	SN200 Mort Lock body	SN200-82271	US26D	SA
50	Interchangeable Core	I/CK-7	626	BE
20	Const. Core	7190224	Green	BE
50	Key Blanks	Best "A" Keyway		BE
2	Electric Strike	9400	630	HS
2	Electric Strike	9500	630	HS
12	Regular Hold Open Arm	25-H	EN	SA
12	Parallel Hold Open Arm	25-PSH	EN	SA
4	Electromagnetic Holder	994M 24VAC	689	RF
5	994M Magnetic Parts	Door Armature 994510M	689	RF
5	994M Magnetic Parts	Screw & Backplate 998300	689	RF
5	994M Magnetic Parts	Swivel Armature 900-3	689	RF
5	994M Magnetic Parts	Magnet Assembly 998369-3V	689	RF
5	994M Magnetic Parts	Wall Cover 998315M	689	RF
5	Motor Assembly Kit	M56A F x SPAR05338		SA
4	SN200 Reader	52 6027 (Exit / Lock)	26D	SA

Notes: All attic stock ships direct to  
Director of Technical Services  
Cy Fair ISD Lockshop  
11430 Perry Road  
Houston, Texas 77064

**Set: 77.0**

Doors: 10, 1000-GH, 1138, 1139, 1808.1, 1808.2, 1811C, 1811D, 2000-F, 72, 84, 9, AS-1000, AS-1001, GH-1001, GH-1002

Description: Not Found

1	Door	Not found	OT
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**Set: 78.0**

Doors: 1060.1, 1060.2, 1841, 1844, 2, 29, 44.1, 44.2, 50, 78, 82

Description: Advise

1	Review	Advise	OT
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END OF SECTION

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## SECTION 08 80 00

### GLAZING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Glass and glazing accessories.
- B. Related Sections:
  - 1. Section 06 40 00 - Architectural Woodwork; display case glass, track, and hardware.
  - 2. Section 07 92 00 - Joint Sealants
  - 3. Section 08 11 00 - Hollow Metal Doors and Frames.
  - 4. Section 08 14 23 - Plastic-laminate-faced Wood Doors.
  - 5. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.
  - 6. Section 08 44 13 - Glazed Aluminum Curtain Walls.

##### 1.2 PERFORMANCE REQUIREMENTS

- A. Glass and glazing materials of this section shall provide continuity of building enclosure vapor and air barrier
  - 1. In conjunction with materials described in SECTION 07 92 00 - JOINT SEALANTS.
  - 2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
- B. Design and size glass to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ASTM E 330.
- C. Limit glass deflection to  $l/200$  or flexure limit of glass with full recovery of glazing materials, whichever is less.

##### 1.3 SUBMITTALS

- A. Submit product data and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Provide data on glazing sealant. Identify colors available.
- D. Samples:
  - 1. Submit 2 samples of each type of glass (except clear glass), 12" x 12" in size, illustrating glass unit, coloration, design.
  - 2. Submit 4" long bead of glazing sealant in color selected.

##### 1.4 QUALITY ASSURANCE

- A. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual."
- B. Source Quality Control: Glass shall be identified by the manufacturer's labels of grade and quality. Temporary labels shall not be removed until final cleaning. Permanent labels on tempered glass shall not be removed.
  - 1. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
  - 2. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- C. Safety Glazing Standard: Where safety glass is indicated or required, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for Category II materials.



- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass and glazing materials during delivery, storage, and handling as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, or temperature changes, and other causes.

## 1.6 WARRANTY

- A. Provide written 10-year warranty signed by manufacturer of insulating glass agreeing to furnish replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, and other visual indications of seal failure or performance.
- B. Provide written 5-year warranty signed by manufacturer of spandrel glass agreeing to furnish replacements for those spandrel glass units developing defects of ceramic frit. Warranty covers deterioration due to normal conditions of use.
- C. Provide written 10-year warranty signed by manufacturer of polycarbonate sheets against breakage, yellowing, hazing, abrasion resistance, loss of light transmission, and coating failure of polycarbonate sheets.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design products are Vitro Architectural Glass (PPG): Provide glass as manufactured by one of the following:
  - AGC Glass North America
  - Guardian Industries Corp.
  - Technical Glass Products
  - Oldcastle Building Envelope
  - Pilkington North America, Inc. (NSG Group)
  - Vitro Architectural Glass (formerly PPG Glass)
- B. Basis of Design Tinted, Low-E glass: Confirm match of specified tinted Low-E glazing with existing tinted Low-E glazing to remain in place. Notify Architect of discrepancies before procuring glazing.

### 2.2 GLASS

- A. (TT1) Tinted, Tempered, Insulating Low-E Glass: Manufacturer's standard 1" thick pre-assembled units consisting of 2 sheets of tempered glass, ASTM C 1048, enclosing a hermetically sealed dehydrated air space; with spacers, sealant, and without protective edge banding. Metal spacers shall be finished to match finish of aluminum storefronts.
  - 1. Interior Pane: Type I, Class 1 (Clear), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition A - Uncoated surfaces; 1/4" thickness.
  - 2. Air Space Thickness: 1/2".
  - 3. Exterior Pane: Type I, Class 2 - Vitro Solargray tint (Tinted Heat-Absorbing and Light-Reducing), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition C - Other coated surfaces with low-emissivity Vitro Solarban 70 coating on second surface; 1/4" thickness.
  - 4. Performance Characteristics: Low-E insulating glass shall comply with the following:
    - a. Solar Heat Gain Coefficient: 0.19
    - b. Winter U-value: 0.28.
    - c. Visible Transmittance: 32%

- B. (TT-IR) Tinted, Impact-Resistant, Insulated Low-E Glass Units: 1-inch thick pre-assembled units consisting of 2 sheets of glazing as specified, enclosing a hermetically sealed dehydrated air space; with spacers, sealant, and without protective edge banding. Metal spacers shall be finished to match finish of aluminum frame systems.
1. Exterior Pane: ASTM C 1048, Type I, Class 2 (Tinted Heat-Absorbing and Light-Reducing) - Vitro Architectural Glass (formerly PPG Industries, Glass Group): Solargray tint, Quality q3 (Glazing select), Kind FT - Fully Tempered, 1/4-inch thick, Condition C (other coated surfaces).
    - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Industries, Glass Group): Solarban 70 low-emissivity (sputtered) coating on 2nd surface.
  2. Air Space-thick: 3/8-inch.
  3. Interior Pane: Impact-resistant laminated safety glazing with proprietary layup, clear, Condition A (uncoated surfaces), 3/8-inch thick; compliant with ASTM F1233 Level 1.3.
    - a. Product: Global Security Glazing: Childgard Security Glazing SG4 attack resistant.
  4. Performance Characteristics: Low-E insulating glass shall comply with the following:
    - a. Visible Light Transmittance: 62%
    - b. Winter U-value: 0.28
    - c. Shading Coefficient: 0.31
    - d. Solar Heat Gain Coefficient 0.27
- C. (CT4) Clear, Tempered Glass: ASTM C 1048, Type I, Class 1 (Clear), Quality q3 (Glazing select). Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thickness.
- D. (CI2) Clear, Impact-Resistant, Laminated Glass: Provide Laminated Glass, two panes of Class 1 (Clear) float glass (ASTM C 1036) of equal thickness, laminated together with not less than 0.09" thick polyvinyl butyl plastic interlayer to provide an overall thickness of 9/16" at interior vestibule. Fabricate laminated glass using laminator's standard heat- plus-pressure process to produce glass free from foreign substances and air/glass pockets.
1. 9/16" thick Monolithic Laminated Glass at Vestibule Interior Storefront:
    - a. Interior Pane: Type I, Class 1 (Clear), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thick.
    - b. Laminated inner layer of 0.09" thick clear polyvinyl butyl plastic manufactured by Solutia Saflex; Eastman Chemical Co. or Trosifol; Kuraray.
    - c. Exterior Pane: Type I, Class 1 (Clear), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thick.
- E. (CI3) Impact-Resistant, Laminated Clear Glass with proprietary layup at locations indicated, clear, Condition A (uncoated surfaces); 3/8-inch thick; compliant with ASTM F1233 Level 1.3.
1. Product: Global Security Glazing: Childgard Security Glazing.
- F. (-F) Glazing Film Glass and plastic finishes field-applied application to glass or plastic material as visual opaque or decorative film.
1. Film: Polyester
  2. Decorative Pattern: Printed, to be selected by Architect from manufacturer's complete range.
  3. Adhesive: Acrylic, Pressure Sensitive, Permanent
  4. Liner: Silicone-coated Polyester
  5. Thickness (Average) (Film and Adhesive without Liner): 3.2 mils
  6. Fire Performance: Surface burning characteristics when tested in accordance with ASTM E84: Class A
    - a. Flame Spread: 25 maximum.
    - b. Smoke Developed: 450 maximum
- G. Clear Glass Mirrors, Unframed: ASTM C 1503, Mirror Select.
1. Nominal thickness 1/4". Backs shall have two coats of silver hermetically sealed, complying with GS-27, with an impervious protective coating of copper deposited over silver by electrolysis, and finished with a special composition hard, mirror-backing paint. Mirrors shall bear manufacturer's labels. Mirrors shall have ground and polished edges.
  2. Mirror Back Safety Tape: ANSI Z97.1.
  3. J-Molds: Provide stainless steel continuous "J" clip at bottom and "J" clips around perimeter of mirror to anchor mirror to wall (Approx. Size: 3/8" x 3/8").

- H. (-FM) Security Film: Field applied security films applied to exterior and interior faces of glass at locations shown as follows:
1. Security Film:
    - a. Exterior: Safety S70X Safety and Security Film (SH7CLARL) as manufactured by 3M. (Addendum No. 3)
      - 1) Optically clear polyester film with abrasion resistant coating on one surface and UV stabilized pressure sensitive adhesive on the other; nominal thickness 7 mils (0.007 inch).
    - b. Interior: Scotchshield Safety and Security Window Film Ultra S800 as manufactured by 3M.
      - 1) Optically clear polyester film consisting of co-extruded microlayers with acrylic abrasion-resistant coating on one surface, and UV stabilized pressure sensitive adhesive on the other; nominal thickness of 8 mils (0.008 inch).
    - c. Install film in one piece edge to edge of glass up to 7'-0" above finish floor, or to bottom of first horizontal mullion, whichever is higher, and with no splices.
  2. Structural Sealant: ASTM C 1184, one part, neutral-cure, silicone sealant for structural glazing, and one of the following:
    - a. IPA as manufactured by 3M
    - b. 995 Silicone Structural Glazing Sealant as manufactured by Dow Corning.
    - c. Apply to perimeter of film, lapping 1/2 inch over edge of film and 1/2 inch onto frame.
  3. Accessories:
    - a. Security Film Anchoring System: BondKap as manufactured by FilmFastener LLC; phone: (888) 212-9375; website: <https://bondkap.com/>
      - 1) Finish to match color of frames at which security film is to be installed.
      - 2) Apply all around perimeter of glass lite to which film is applied to cover sealant applied to film and frame.

## 2.3 GLAZING MATERIALS

- A. Glazing Compound: Comply with ASTM C 1311 or FS TT-S-00230, one-part, non-sag acrylic polymeric sealant. Product/manufacturer; one of the following:  
Acryl-R Acrylic Sealant; Schnee-Moorehead, Inc.  
Mono 555; Tremco
- B. Channel Glazing Strips; Hollow Metal Doors and Frames: Provide black vinyl channel glazing strips, Glazing Vinyl for 990 Sliders Part #6062-01 as manufactured by Kawneer.
- C. Glazing Compound for Fire-Rated Glazing Materials:
  1. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq.-inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
  2. Glazing Compound: DAP 33 putty.
  3. Setting Blocks: Neoprene, EPDM,; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
  4. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.
- D. Mirror Mastic: Combination of asphaltic bitumens, fibers and mineral spirits. Product/manufacturer; one of the following:  
Gunther Pro®; Gunther Mirror Mastics  
7HR4 Mirror Tac®; Pecora Corp.  
Mirro-Mastic; Palmer Products Corporation.
- E. Accessories: Setting blocks, tape, vinyl gaskets and spacer strips as required for a complete installation.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive glass for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.
1. Confirm fit of specified glazing and glazing units into glazing pocket of existing-to-remain frames and new frames to receive new glazing. Notify Architect of unsatisfactory conditions.

### 3.2 INSTALLATION

- A. Setting Glass: Glazing shall be done at the site by skilled glaziers in conformance with the general conditions governing glazing in the GANA Glazing Manual.
  - 1. Glazing of aluminum windows and storefront shall be done in conformance with the methods recommended by the manufacturer of the aluminum items. Beads or stops furnished with the items to be glazed shall be used to secure the glass in place.
  - 2. For interior hollow metal door and frame glazing, install channel glazing strips and place glass within glazing strips. Install the removable stop and position the channel glazing strip to seal completely the void around the glass.
  - 3. Verify glass sizes for required edge clearances by measuring the openings. Cut each piece accurately and fit to its particular position. Center glass in the opening vertically and horizontally. Use edge blocks in vertical jambs to prevent lateral "walking" of the glass.
  - 4. Glass shall have clean cut edges. Do not seam, nip, stone or strike edges, or scarf corners, and do not install glass with flared edges at the bottom. Do not bump, drag, or rest the edge of a glass light against metal or other hard objects.
  - 5. Set tempered glass with tong marks completely concealed or in as inconspicuous a location as possible.
- B. Application of Window Film:
  - 1. Refer to the applicable 3M Installation Guide for specific application instructions.
  - 2. Do not proceed with installation until all finishing work has been completed in and around the work area.
  - 3. Comply with manufacturer's application instructions applicable to products and applications indicated, except where more stringent requirements apply.
  - 4. Remove the film liner and wet the adhesive prior to installation.
  - 5. Form smooth, wrinkle-free, bubble-free surface for finished installation.
  - 6. Remove air bubbles, wrinkles, blisters and other defects. Use manufacturer-approved procedures to prevent the formation of air bubbles, wrinkles, blisters and other defects.
  - 7. Residual water may cause small water bubbles or clouding in the film that will disappear as the water evaporates.
- C. Glass Mirrors:
  - 1. Apply one additional coat of moisture-resistant paint, type recommended by manufacturer, to back of mirror.
  - 2. Allow to dry.
  - 3. Apply safety tape to back of mirror in strips leaving 25% of surface free for application of mastic.
  - 4. Apply mirror mastic to cover not more than 25% of back mirror, 1/8" to 1/2" thickness of setting bed.
  - 5. Set mirror on concealed shelf angle.
  - 6. Press mirror against substrate to bond.
  - 7. Leave open ventilation space, 1/8" minimum between mirror and substrate.
  - 8. Do not seal off ventilation space at edge of mirror.

### 3.3 CLEANING

- A. Upon completion of glazing, clean glass on both sides and remove labels and other defacement. Replace damaged glass with new.
- B. Applied Window Film:
  - 1. Use cleaning methods recommended by window film manufacturer for applicable environment.
  - 2. Protect completed glass finish during remainder of construction period.

END OF SECTION

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SECTION 08 91 00

LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fixed, extruded-aluminum wall louvers.

1.2 SUBMITTALS

- A. Submit the following according to Section 01 33 00 - Submittals:
1. Product Data: Manufacturer's complete product information and installation instructions.

1.3 QUALITY ASSURANCE

- A. Comply with SMACNA *Architectural Sheet Metal Manual* recommendations for fabrication, construction details and installation procedures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Louver Type:
1. Dade County approved, depth as required for wall thickness, stationary, wind-driven rain resistant type.
  2. 6063-T6 extruded aluminum alloy, minimum 0.080-inch thick frame and minimum 0.060-inch thick blades.
  3. Product/ manufacturer; one of the following:  
Model DC-5304; Construction Specialties, Inc.  
Model SP-537DC; Industrial Louvers, Inc.  
Model IL-50; Louvers & Dampers, Inc.

2.2 MATERIALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- C. Fasteners shall be aluminum. Provide types, gages and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners.
- D. Screens: Provide removable screens consisting of U-shaped metal for permanently securing screen mesh. Provide bird screens of 1/4" sq. mesh, 0.063" aluminum.
- E. Insulated Metal Blank-off Panel: Provide insulated metal blank-off panel (painted black) at all louver areas not utilized by mechanical ducts at mechanical rooms.
- F. Aluminum Finish: Aluminum surfaces of louvers and all their associated parts shall be Kynar 500®/Hylar 5000®, a minimum 1 mil thick full strength 70% resin fluoropolymer coating. Screw and bolt heads exposed to view shall be finished to match the exposed aluminum surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the louvers in accordance with the manufacturer's recommendations.
- B. Install louvers straight and plumb with horizontal lines level. Completed installation shall be rigid and weathertight.
- C. Use concealed anchorages wherever possible.

- D. Provide concealed gaskets and flashings and install as work progresses to make installations weathertight.

END OF SECTION

SECTION 09 21 13

PLASTER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Furring, lathing, framing and plaster construction.
- B. Related Sections:
  - 1. Section 05 40 00 - Cold-formed Metal Framing.
  - 2. Section 07 27 00 - Air Barriers; behind exterior vertical plaster.
  - 3. Section 07 48 00 - Rainscreen Attachment System; Clip & Rail System
  - 4. Section 09 21 16 - Gypsum Board Assemblies: Glass mat gypsum sheathing.
  - 5. Section 09 91 00 - Painting.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data: Submit product data with installation instructions.
- C. Shop Drawings: Submit a diagram of proposed control joint and expansion joint layout prior to starting work.
- D. Samples: Include color chips for color selection.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with:
  - 1. ML/SFA (Metal Lath/Steel Framing Association).
  - 2. PCA (Portland Cement Association) Plaster (Stucco) Manual.
  - 3. Lath & Plaster Systems Manual published by Texas Lathing and Plastering Contractors Association and Texas Bureau for Lath & Plaster.

1.4 PROJECT CONDITIONS

- A. Environmental Requirements: In cold weather, maintain the temperature of the building reasonably constant at not less than 55°F. for an adequate period prior to, during, and after the plastering operation. Provide adequate ventilation to dry plaster.
- B. Protection: Provide protection during plastering for finished door and window frames and other designated areas which do not receive a plaster finish.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C 150, domestic manufacturer.
- B. Lime: ASTM C 206, hydrated finishing lime.
- C. Sand: ANSI/ASTM C 897 clean, sharp plaster sand.
- D. Water: Clean and free of deleterious amounts of acids, alkalis, or organic materials.
- E. Cement Plaster Finish Coat: Mill prepared, water-resistant finish for use over Portland cement base coats; color as selected by Architect. Product/manufacturer; La Habra Exterior Stucco.
- F. Hangers: No. 8 gage annealed, galvanized wire.



- G. Tie Wire: No. 16 gage annealed, galvanized wire for channels, No. 18 gage for lath.
- H. Metal Lath: Diamond-mesh, expanded-metal lath, hot-dip galvanized zinc coating.
  - 1. 3.4 lb. lath for horizontal work.
  - 2. 2.5 lb. lath for interior vertical work.
  - 3. 3.4 lb. self-furring lath with drainage mesh for exterior vertical work:
    - a. Provide LathNet Expanded Metal Lath with Attached Drainage Mesh as manufactured by Mortar Net Solutions or approved equivalent. 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C 847, with 1/4 inch high loft non-wove attached drainage mesh. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).
- I. Corner Mesh: Formed galvanized sheet steel; minimum 26 gage thick; expanded flanges shaped to permit complete embedding in plaster; minimum 2" size.
- J. Strip Mesh: Expanded galvanized metal lath, minimum 26 gage thick; 4" wide x 24" long.
- K. Channels: 16 gage cold rolled steel, painted.
  - 1. Furring channels; 3/4" x 1/2" weighing 300 lbs./M ft.
  - 2. Runner channels; 1 1/2" x 9/16" weighing 475 lbs./M ft.
- L. Weather Resistive Barrier: ICC-ES AC38, Grade D, 10-minute water-vapor-permeable, asphalt-saturated kraft building paper.

## 2.2 PLASTERING ACCESSORIES

- A. Provide custom radiused collars at columns, custom curved casing and corner beads, and custom curved reveals as required. The following products are available from Clark Dietrich or CEMCO Steel and are referenced by their product numbers.
  - 1. Corner Beads: No. 1-A small-nose corner beads of expanded flange 26 gage galvanized steel.
  - 2. Casings: No. 66 square expanded flange casing beads of 26 gage galvanized steel.
  - 3. Control Joints: No. 15 double "V" control joint of 26 gage galvanized steel or as shown on the drawings.
  - 4. Expansion Joints: No. 40 two-piece adjustable expansion joints of 26 gage galvanized steel.
  - 5. Corner Control Joints: No. 30 expansion joints of 26 gage galvanized steel.
- B. Reveal Molding: Provide Channel Screeds of aluminum extruded alloy 6063 T5 with chemical conversion coating. Fry Reglet Model Nos. PCS-75-V-100 (1" vented) and/or PCS-75-50 (1/2" reveal), as indicated on drawings
- C. Weep Screeds: No. 7 foundation sill weep screed, with sloped ground and minimum 3-1/2 inch vertical attachment flange, fabricated of 26 gage galvanized steel. Available from Clark Dietrich or CEMCO Steel

## 2.3 PLASTER BASE COAT MIXES

- A. Mix and proportion cement plaster in accordance with PCA Plaster (Stucco) Manual and in accordance with manufacturer's instructions.
- B. Do not re-temper or use material that has partially set. Do not use frozen, caked or lumpy materials. Clean mixer or mixing boxes of set of hardened materials before materials for a new batch are loaded. Mix each batch separately. Thoroughly dry mix materials before adding water.
- C. Portland Cement: For both coats under cement plaster (stucco) finish coat.
  - 1. Scratch coat, by volume:
    - Sack Portland cement
    - 2 Sacks Masonry Cement
    - Nine Cubic Feet Sharp Torpedo Sand
    - 1-1/2 lbs of 1/2 inch Alkaline Resistant Fiberglass Strands (Add Last)
  - 2. Brown coat, by volume:
    - 1 Sack Portland cement
    - 2 Sacks Masonry Cement
    - 10 Cubic Feet Sharp Torpedo Sand
    - 1-1/2 lbs of 1/2 inch Alkaline Resistant Fiberglass Strands (Add Last)
    - Integral Liquid or Powder Waterproofing in Accordance with Manufacturer's Recommendations

- D. Mix only as much plaster as can be used prior to initial set.
- E. Mix materials dry, to uniform color and consistency, before adding water.
- F. Protect mixtures from frost, contamination, and evaporation.

## 2.4 PLASTER FINISH COAT MIXES

- A. Cement Plaster (18A): Finish coat mix shall be the mill prepared, exterior, colored finish as selected by Architect.

## PART 3 - EXECUTION

### 3.1 METAL FURRING AND LATHING

- A. General: Comply with ML/SFA 920, "Guide Specifications for Metal Lathing and Furring", and with requirements of ASTM C 1063.
- B. Soffits:
  - 1. Space hangers so that each hanger supports a maximum area of 16 sq. ft. 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.
  - 2. Erect runner channels on 4' centers or closer and locate a channel within 4" of each parallel wall. If runner channel spans between hangers are more than 4' but less than 5 ft., use 1.12 lb. 1½" runner channels. If spans between hangers are 5' or more, use boxed 1½" channels, 2" channels, or heavier as required.
  - 3. Erect furring channels at right angles to runner channels with joints lapped and made at hangers and crossings only. Provide a channel next to each wall. Space ¾" furring channels on 13½" centers. Saddle-tie channels to runners with two strands of wire at each crossing.
  - 4. Brace vertical furring channels with horizontal channels on 4' centers where possible. Provide additional bracing and cross-bracing to make all furring rigid and secure.
  - 5. 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. Lathing:
  - 1. Install according to ASTM C1063.
  - 2. Apply lath with the lengths of the sheets at right angles to supports. Side laps and end laps shall be 1", with end laps staggered and made at supports only. Tie all laps 6" o.c. and tie to each channel at 6" o.c.
  - 3. Break lath behind the control joints in cement plaster surfaces.
  - 4. At exterior vertical surfaces:
    - a. Within 30 days of sheathing board application, apply 2 layers of weather resistive barrier over sheathing in horizontal layers with each strip lapping the strip below at least 3". Install per manufacturer's written instructions.
    - b. Screw attach self-furring lath with drainage mesh to framing members.
- D. Accessories:
  - 1. Install corner beads on projecting plaster corners. Set beads straight and parallel with building lines.
  - 2. Install casings where detailed and in all places where plaster abuts metal, masonry and other dissimilar materials.
  - 3. Install control joints in cement plaster surfaces complying with the following criteria and as acceptable to Architect. Make up control joints with adjustable expansion joints set with a ⅛" gap. Extend control joints through corner beads and casings to isolate the areas.
    - a. Where an expansion or control joint occurs in substrate.
    - b. At not more than 10' in either direction.
    - c. Where area of Portland cement panel exceed 100 sq. ft.
  - 4. Install reveal molding where detailed, at soffits and furrings.
  - 5. Install corner expansion joints at intersections of plastered interior partitions with plastered exterior walls.
  - 6. Install foundation weep screed at bottom of all vertical plaster surfaces.

- E. Grounds: Set grounds and casings at 1" for three coats of plaster except for fireproofing plaster.

### 3.2 APPLICATION - GENERAL

- A. Apply plaster in accordance with ASTM C 926, PCA Plaster Manual, and manufacturer's instructions. Utilize most stringent requirements if conflicts exist.
- B. Apply plaster by machine or hand. Interrupt plaster only at junctions of plaster planes, at openings or at control joints.
- C. Layout to permit completion of an entire surface in one application. Maintain a wet edge. Work to corners and joints, and do not allow material to set up within a distinct wall area.
- D. Interrupt plaster at control joints. Tool through second and finish coat to produce "V" joint at intersection of frames and other items of metal or wood which act as plaster grounds.
- E. Nominal Plaster Thicknesses

	SOFFITS	WALLS
1. First Coat:	3/8"	1/2"
2. Second Coat:	1/4"	3/8"
3. Third Coat:	1/8"	1/8"

### 3.3 APPLICATION OF PLASTER BASE COATS

- A. Scratch Coat: On lath, apply scratch coat with sufficient pressure to obtain good key and to lightly cover the lath. Roughen for bond and allow to cure 24 hours. Damp cure scratch coats at least 48 hours.
- B. Brown Coat: Apply brown coat with pressure, bring up to grounds, work with straight edges, and rod to straight, true surfaces. Broom or scratch for bond. Damp cure at least 48 hours.

### 3.4 APPLICATION OF PLASTER FINISH COAT

- A. Cement Plaster: Mix and apply the mill prepared finish coat in conformance with the manufacturer's directions. The cement plaster shall have a uniform sand texture finish.

### 3.5 EXISTING PLASTER REPAIR

- A. Ensure existing substrate is sound.
- B. Remove plaster adjacent to repair area that is cracking, chipping, and spalling off, then remove old paint from adjacent area.
- C. Scarify adjacent old plaster area and apply bonding agent to prevent old plaster from extracting water from the new plaster before it cures.
- D. Patch holes with new plaster and blend the finish coat with adjacent scarified areas.

### 3.6 ADJUSTING

- A. Upon completion, point-up plaster around trim and other locations where plaster meets dissimilar materials.
- B. Apply fog coat to integral color plaster to ensure uniform color.
- C. Cut out and patch defective or damaged plaster. Cut out and patch stained or discolored finish plaster.
- D. Match patch of defective or damaged plaster to existing work in form, texture and color.
- E. Obtain Architect's acceptance of plaster color and texture prior to scaffold removal.

### 3.7 TOLERANCES

- A. Maximum variation from true flatness:  $\frac{1}{8}$ " in 10' as measured with a straight edge placed at any location on the surface.

### 3.8 PATCHING

- A. Patch defects in workmanship and materials. Patches in finished areas shall match adjacent surfaces.

END OF SECTION

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SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Metal stud wall framing.
  - 2. Furred wall framing.
  - 3. Metal channel ceiling framing.
  - 4. Gypsum board partitions, ceilings, and furrings
  - 5. Finishing of panel joints.
- B. Related Sections:
  - 1. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
  - 2. Section 05 40 00 - Cold-Formed Metal Framing: exterior wall studs.
  - 3. Section 07 21 00 - Building Insulation: acoustical and thermal insulation.
  - 4. Section 07 84 00 - Firestopping.

1.2 SUBMITTALS

- A. Product Data: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES. Submit materials list of items proposed to be provided, manufacturer's data indicating compliance with specified requirements, and manufacturer's recommended installation procedures.
- B. Submit diagrams of proposed control joint and expansion joint layout prior to starting work.

1.3 QUALITY ASSURANCE

- A. Tolerances for Drywall: Do not exceed a variation of 1/8" in 10'-0" and 1/16" in 5'-0" from plumb, level, and flat (all directions) and do not exceed 1/16" offset of planes at joints between panels. Shim panels as necessary to comply with tolerances.
- B. Perform Work in accordance with ASTM C 840, GA-216, GA-223 and GA-600.

1.4 PROJECT CONDITIONS

- A. Environmental Requirements: In cold weather, maintain the temperature of the building reasonably constant at no less than 55° F. during gypsum panel application and joint finishing. Provide adequate ventilation to carry off excess moisture.

1.5 DELIVERY, STORAGE, HANDLING

- A. Deliver, store, handle, and protect products in conformance with manufacturer's instructions and in accordance with Section 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- B. Store inside building, on sleepers, and out of water.

1.6 QUALIFICATIONS

- A. Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Gypsum Board: 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. Partition Closure: Provide "Mullion Mate (Series 30)" extruded aluminum partition closure as manufactured by Gordon Interior Specialties Division, Gordon, Inc., or approved equivalent. (phone: (800) 747-8954, website: [www.gordoninteriors.com](http://www.gordoninteriors.com)).
1. Unit shall be pre-assembled and spring loaded to provide a tight fit for vertical junctures of partitions and window mullions.
  2. Finish to be clear anodized to match mullions curtainwall/storefront finish.
  3. Sound tested to a composite STC of 35 with acoustical batts for sound attenuation.
  4. Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI (ASTM B 221, ASTM B 221 M).
  5. Acoustical Batts for sound attenuation (Reference Section 07 21 00 - Building Insulation). Factory-supplied caulk must be installed in the field for acoustical performance purposes.
  6. Accessories: Provide Mullion Mate End Caps per drawings.
  7. Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest-grade commercial type.
- C. 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.
- D. Slotted Top Track: Sliptrack Systems, SLP-TRK®, (phone 888.475.7875 web site: [www.sliptrack.com](http://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.
- E. 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.
- F. 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.
- G. Adhesive: Utilize adhesive meeting requirements of GA-216 over metal framing.
- H. 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).

I. Special Trim: Softforms reveals by Pitcon Softforms as detailed.

## 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.
  12. At vertical junctures of partitions and window mullions, provide pre-assembled, spring loaded, partition closure pieces.
- 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. 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.
- J. Special Finishes for Gypsum Board Surfaces:
1. Areas Designated with Dry Erase Coating (paint-type) and Custom Digital Vinyl Wallcovering (Graphics): Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 5 Finish per ASTM C840 and GA-214-Recommended Levels of Gypsum Board Finish. Recess nails and screws. Repair irregular tape joints, sand and remove dust. Ensure gypsum wallboard surfaces scheduled to receive dry-erase coatings are properly primed with recommended primer.
  2. Areas Designated with Dry Erase Wall Covering and Wall Protection Panels: Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, per ASTM C840 and GA-214-Recommended Levels of Gypsum Board Finish.
  3. Permanent lighting should be installed and operational for inspection of these areas prior to application of wall finish.

### 3.2 TOLERANCES

- A. Maximum variation from true flatness: 1/8" in 10 feet in any direction.

END OF SECTION

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SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Porcelain Tile.
  - 2. Tile Trim and Accessories.
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry; wood blocking at windowsills.
  - 2. Section 07 92 00 - Joint Sealants.
  - 3. Section 09 21 16 - Gypsum Board Assemblies.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Submit manufacturer's written product data for each tile type and accessory.
- C. Samples: Submit tile samples of the same size scheduled for each particular type of tile required.
- D. Certificate: Furnish one master grade certificate on ceramic tile executed prior to delivery of the tile to the site.

1.3 QUALITY ASSURANCE

- A. Standard: Tile shall be Standard Grade complying with the requirements of ANSI A 137.1. Deliver tile to the project site in grade sealed containers.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained.
- B. Do not install adhesives in a closed, unventilated environment.
- C. Maintain 50°F. during installation of mortar materials.

1.5 MAINTENANCE

- A. Extra Materials: Upon completion of work, deliver to the project site one box for each type, color, pattern, and size of tile installed. Furnish maintenance materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identifying labels.

PART 2 - PRODUCTS

2.1 TILE

- A. Manufacturers: Ceramic tile and trim as manufactured by American Olean, Dal-Tile Corp., 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 and Base: Reference "Material Finish Schedule" in drawings for manufacturer, product, color and finish of tile.

- C. Trim Pieces:
  - 1. Provide factory made fitters and trim shapes required for a finished installation. Keep job-cut fitters and trim shapes to a minimum. Provide bullnose tile at horizontal and vertical tile edges.
- D. Floor Tile Wet Dynamic Coefficient of Friction: Not less than 0.42, when tested in conformance with ANSI A137.1.

## 2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C 150, domestic manufacture.
- B. Dry-Set Mortar: ANSI A 118.1, factory sanded mortar mix.
- C. Latex-Portland Cement: ANSI A 118.15, flexible mortar consisting of cement-based mix and latex additive.
- D. Floor Grout: 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.
- E. Lime: ASTM C 207, Type S, hydrated lime.
- F. Sand: ASTM C 144, clean, masonry sand.
- G. Water: Clean and potable.
- H. Reinforcement: 1-1/2" x 17 gage galvanized woven steel wire fabric or 2 x 2 x 16/16 gage galvanized welded steel wire fabric.

## 2.3 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.

## 2.4 ACCESSORIES

- A. Metal Floor Transition Trim: As scheduled; reference Drawings. Finish shall be satin anodized aluminum. Height as required to flush out with top of tile flooring.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Sweep concrete slab surfaces clean and free of dirt and debris. Remove oil, grease, paint, and dried mortar.
- B. 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. 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. 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.
7. Keep all joint lines straight and even width, including miters.
8. Thoroughly back-up with thin-set bonding material all thin-set units, molded or shaped pieces; secure firmly in place.
9. 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.
10. 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.
11. Finish floor areas level and plumb with no variations exceeding 1/8" in 8' from the required plane.
12. 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.
13. Finished tile work shall be clean. Replace pitted, chipped, cracked and scratched tiles.

#### B. 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.

#### C. 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.

#### D. Metal Floor Transition Trim:

1. Provide at transition of ceramic floor tile to lower flooring material (e.g. vinyl composition tile, exposed concrete, etc.) where no marble threshold is detailed.
2. Install as detailed on drawings.
3. Set transition trim prior to installing ceramic floor tile.
4. Set tile up tight to transition trim with a factory cushion edge. Trim shall be flush with top of ceramic tile.
5. After tile work and grout are dry, clean the joint between the trim and the tile.
6. Fill joint between trim and ceramic floor tile with sealant to match grout.

### 3.3 CLEANING

#### A. When the work of other trades is completed, clean down tile and marble surfaces and leave in first class condition.

1. The use of wire brushes or acids is expressly prohibited.
2. Replace cracked, broken, and chipped tile with new units.
3. Correct uneven and stained joints.

END OF SECTION

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SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Acoustical panels and exposed suspension systems 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 work 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. (ACT-01) Acoustical Lay-in Panels: ASTM E 1264, mineral fiber panels, Class A (non-combustible) and having an NRC range of min. 0.50-0.60.
1. Sizes: 24" x 24" x 5/8"
  2. Basis of Design: Armstrong School Zone Fine Fissured as scheduled; refer to Drawings.
  3. Edge Condition: Square.
  4. Color: White.
  5. Acceptable Manufacturers  
CertainTeed Architectural  
USG Interiors, Inc.
- B. (ACT-02) Acoustical Lay-in Panels: ASTM E 1264, mineral fiber panels, Class A (non-combustible) and having an NRC range of min. 0.55 or better.
1. Sizes: 24" x 24" x 5/8"
  2. Basis of Design: Armstrong Cortega 770 as scheduled; refer to Drawings.
  3. Edge Condition: Square.
  4. Color: White.
  5. Acceptable Manufacturers  
CertainTeed Architectural  
USG Interiors, Inc.
- C. (ACT-03) Acoustical Lay-in Panels - Extra High NRC: ASTM E 1264, mineral fiber panels, Class A (non-combustible) and having an NRC range of min. 0.85 or better.
1. Sizes: 24" x 24" x 3/4"
  2. Basis of Design: Armstrong Calla 2820 as scheduled; refer to Drawings.
  3. Edge Condition: Square.
  4. Color: White.
  5. Acceptable Manufacturers  
CertainTeed Architectural  
USG Interiors, Inc.
- D. (ACT-0) Membrane-Faced Acoustical Lay-in Panels – Washable: ASTM E 1264, Type IV mineral base with membrane-faced overlay panels, Form 2 (water felted), Pattern E (lightly textured), Class A.
1. Product / manufacturer: Armstrong World Industries; Clean Room VL 868.
  2. Size: 24 x 24 inches x 5/8 inch thick.
  3. Finish: Washable factory-applied vinyl membrane.
  4. Edges: Square.
- E. (ACP-01) Pyramid Diffuser Panels: Provide Inverted Pyramid diffuser panels as manufactured by Wenger Corp.
1. Material: Class A PVC plastic 0.125".
  2. Finish: Acrylic factory-finished paint.
  3. Size and Type: 4' x 4' x 16", off-set inverted pyramid, weight 15 lbs.
  4. Weight: Minimum 1/2 pound per square foot of surface area.
- F. Suspension System; Acoustic Lay-in Panels (ACT-01, ACT-02, ACT-03): 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. System shall be designed and sized to support the ceiling assembly with a maximum deflection of L/360 of the span.
  4. Components shall be electro-zinc coated or hot-dip galvanized and exposed surfaces shall have enamel finish.

- a. Color (ACT-01, ACT-2, ACT-03): White.
- G. Suspension System: Membrane-Faced Acoustical Lay-in Panels – Washable (ACT-04): ASTM C 635, heavy duty, 15/16" hot dipped galvanized steel, with aluminum cap with white finish.
  - 1. Product/manufacture: one of the following:
    - Prelude Plus XL Fire Guard Environmental Tee System; Armstrong World Industries
    - 15/16" EZ Stab Classic Environmental System; CertainTeed Corp.
    - 260 Aluminum Cap 15/16"; Chicago Metallic Corp.
    - DXLA DONN Brand Acoustical Suspension System; USG Interiors, Inc.
  - 2. Exposed main tee runners shall be double web with aluminum-capped face.
  - 3. 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.
  - 4. Components shall be electro-zinc coated or hot-dip galvanized. Exposed surfaces shall be capped with aluminum with enamel finish.
    - a. Color: White
- H. Hangers: 12 gage annealed and galvanized steel wire.
- I. Hold-down Clips: UHDC Universal Hold Down Clip by Armstrong.
- J. Direct Load Ceiling Clip: DLCC as manufactured by Armstrong.
- K. Column Rings: Prefabricated clamp rings to support suspended ceiling, as manufactured by Fry Reglet.

## 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. Hold-down clips are required at all vinyl covered gypsum panels for cleaning purposes.

- 2. Provide hold-down clips at lay-in panels within 6' of exterior exits and at areas indicated.
- 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.
- B. After installation, clean soiled and discolored surfaces. Remove damaged units and replace with new.

END OF SECTION

SECTION 09 64 53

REFINISHING OF RESILIENT WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Refinishing of resilient wood athletic 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 acceptance of the building. 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 Solvent-based: Gold Medalist Wood Seal durable urethane sealer as manufactured by Hillyard Industries, Inc.
  - 2. Gym Finish Solvent-based: 450 Gym Finish high-solids, urethane wood gym finish as manufactured by Hillyard Industries, Inc.
  - 3. Gym Marking Paint: Gym Line Paint as manufactured by Hillyard Industries, Inc.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine area to be 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.
- C. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

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 carpenter's 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 2 coats of penetrating sealer, buffing and cleaning between each coat.
  - 2. Game-Line and Marker Paint: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
    - a. Mask flooring at game lines, markers, and logos and apply paint to produce lines and markers with sharp edges.
    - b. Apply finish coats after game-line and marker paint is fully cured.
  - 3. Apply 3 coats of gym finish, buffing and cleaning between each coat.

### 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 64 55

TEMPERED HARDBOARD FLOORING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Stage flooring system.
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry: Plywood underlayment and subflooring.
  - 2. Section 07 21 00 - Building Insulation: Rigid insulation between screeds.

1.2 QUALITY ASSURANCE

- A. Provide any certification documents required by Federal, State, or Local Codes indicating that all combustible stage flooring materials have been treated with a fire retardant recognized and approved by the authorities enforcing those codes.

1.3 STORAGE AND HANDLING

- A. Storage and handling in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- B. Flooring shall be delivered to and stored in the area to be floored at least two weeks before the floor is to be laid. The area must be under proper and protected ventilation and heating.

1.4 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. until final acceptance of the building.
- B. Protection: Protect stage flooring from damage during and after installation. Cover traffic areas with paper and maintain until final acceptance of the building.

1.5 MAINTENANCE

- A. Extra Materials: Provide 5% spare 4'-0" x 8'-0" panels of tempered hardboard to the Owner for future replacement. Spare panels are to be painted and neatly stacked on a 2 x 4 frame supporting the pieces 24" o.c. both directions. Cover spare panels with a plastic drop cloth.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Flooring: APA PS 1-09; Tempered hardboard laminated to both faces of softwood plywood panels, 3/4-inch overall panel thickness; factory-cut to 4'-0" x 8'-0" pieces; screwed to subflooring with 1-1/4" screws at 12" o.c. along sleepers.
  - 1. Product: Tempered Plyron as manufactured by Swanson Group, website: [www.swansongroup.biz](http://www.swansongroup.biz), phone: 541-744-3422; or an equivalent product approved by Architect by another manufacturer.
- B. Subflooring:
  - 1. Framing: Fire-retardant treated 2 x 4.
  - 2. Decking: Reference SECTION 06 10 00 - ROUGH CARPENTRY.
    - a. Bottom Layer: 3/4-inch softwood plywood
    - b. Top layer: 1/2" thick softwood plywood.
  - 3. Pads: 6" x 6" x 5/16" neoprene waffle pad, 40 durometer, as manufactured by Mason Industries or L & N Sales.
  - 4. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6-mils thick.
  - 5. Insulation: Reference Section 07 21 00 - BUILDING INSULATION.
  - 6. Screws: 1" Sheet Rock Flathead to be countersunk.

- C. Finishing Materials; Paint: Porch & Floor Enamel, 107.41, satin, as manufactured by Sherwin Williams. Color shall be as selected by Architect.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine area to receive tempered hardboard floor 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. At least 10 days prior to the installation of the stage floor, prepare the tempered hardboard for installation by assuring maximum moisture content and thus maximum expanded size.
  - 1. Perform this preparation process indoors at temperatures above 40°F. Do not allow the tempered hardboard to freeze.
  - 2. As each sheet is stacked, sprinkle it until the outer surfaces and edges are damp, but not saturated.
  - 3. Cover the entire stack with a plastic drop cloth, so that the moisture can permeate the entire stack.
  - 4. Once the moisture content of the tempered hardboard has been raised, it should be installed before it has the opportunity to dry-out and contract.
- B. Concrete floor slab surface shall be completely dry before flooring is laid. Sweep the surface clean and free of dirt and remove oil, grease, paint, dried mortar and curing compound residue.

### 3.3 INSTALLATION

- A. Subflooring:
  - 1. Vapor Retarder: Install with joints lapped a minimum of 6" and sealed.
  - 2. Construct subfloor framing of fire retardant treated 2 x 4 wood sleepers, flat side down, placed 24" o.c. and supported at each sleeper junction (24" o.c.) by a neoprene waffle pad.
  - 3. Install sleepers and padding around all floor mounted boxes, trap openings, and wall lines. Sleepers are to be free floating; do not anchor to support structure.
  - 4. After all conduit, boxes, sleepers, and pads have been installed and leveled for the final floor elevation, fill the remaining space with insulation.
  - 5. Construct the subfloor decking of two layers of fire retardant treated plywood; stagger the joints of one layer with the other. The bottom layer shall be 3/4" thick and the top layer shall be 1/2" thick.
  - 6. Attach each layer with 1" screws at 12" o.c. along sleepers. Absolutely no nails shall be used. Offset screw pattern for each layer by 6".
- B. Flooring:
  - 1. Prepare the surface of the subfloor decking by cleaning, drying, and leveling.
  - 2. During the installation process the remaining tempered hardboard-faced panels shall be kept under plastic drop cloths at all times.
  - 3. Install the 4' x 8' tempered hardboard faced panels in a stagger joint pattern with rows starting with one piece centered at the front edge of the stage. Allow 1/16" gap at all joints.
  - 4. Install one screw centered in the panel; follow with screws in a square pattern centered midway between the center and the edge. Start with a screw at the midpoint of each side; work toward the corners; install screws 12" o.c. maximum, 1/2" from the edge around the perimeter. Countersink all screws.
  - 5. Where panels are interrupted by floor boxes, attach panels 6" o.c. around the devices, 6 screws minimum.

### 3.4 FINISHING

- A. Finish floor and spare panels with two coats of paint.
  - 1. Mask off outlets and engraved labels in or on floor boxes.
  - 2. Apply with a napped roller to create a non-gloss, non-slip surface.

### 3.5 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.

END OF SECTION

SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Luxury vinyl tile flooring, rubber base, and accessories.

1.2 SUBMITTALS

- A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit manufacturer's standard color samples of tile, not less than 3" x 3", full thickness. Submit samples of each accessory, full height or width by not less than 2" length.
- B. Concrete Slab Testing
1. Alkalinity and Adhesion Testing:
    - a. Submit result of pH tests.
    - b. Submit written documentation of acceptable pH levels of selected flooring manufacturer.
    - c. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.
    - d. Proceed with installation only after substrates pass testing.
  2. Relative Humidity Probe Tests:
    - a. Submit results for in situ relative humidity probe tests.
    - b. Submit date and time measurements were made.
    - c. Submit locations and depth of probe holes.
    - d. Submit temperature and relative humidity in each probe hole.
    - e. Submit ambient air temperature.
    - f. Acceptable relative humidity is typically 75% or less. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have relative humidity percentage stated as acceptable by manufacturer.
    - g. Submit letter from flooring manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
  3. Anhydrous Calcium Chloride Testing
    - a. Submit time and date of placement and retrieval.
    - b. Submit ambient air temperature and humidity during test duration
    - c. Submit manufacturer's instructions and relative technical data.
    - d. Acceptable moisture emission rates are typically 3 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 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 and 48 hours for installation of rubber 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. Luxury Vinyl Tile: Provide manufacturer's minimum of 20-Year Commercial Warranty.



- B. 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. Luxury Vinyl Tile (LVT-01, LVT-02, LVT-03): ASTM F 1700, Class 3, Type B.
  - 1. Colors and Sizes: Provide colors and sizes as scheduled in "Material Finish Schedule" on drawings.
  - 2. Products shall have a minimum wear layer of 20 mil.
  - 3. Products/Manufacturers: "Event Abstract" as manufactured by Tarkett.
    - a. Color and size as scheduled; refer to Drawings.
- B. Luxury Vinyl Tile (LVT-04): ASTM F 1700, Class 3, Type B.
  - 1. Colors and Sizes: Provide colors and sizes as scheduled in "Material Finish Schedule" on drawings.
  - 2. Products shall have a minimum wear layer of 20 mil.
  - 3. Products/Manufacturers: Movenio Stones as manufactured by Mohawk.
    - a. Color and size as scheduled; refer to Drawings.
- C. Rubber Base (BC-01, BC-02): ASTM F 1861, Type TS (rubber, vulcanized thermoset), Style Cove (with top-set toe), 1/8" thick, 4" high. Color(s) as scheduled; refer to Drawings. Furnish base in manufacturer's continuous rolls. Outside corners shall be factory formed pre-molded units matching base in color and finish. Product/manufacturer; one of the following:
  - Baseworks™ Thermoset Rubber Wall Base; Tarkett/Johnsonite
  - Pinnacle Type TS Rubber Base; Roppe Rubber Corp.NO SUBSTITUTIONS on Type TS (rubber, vulcanized thermoset)
- D. Edge Strips: 1" wide by 1/8" thick black 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. Adhesive shall have an RH rating of 99 or higher. If using adhesive with an RH rating below 99, the contractor must provide moisture tests for every area to receive LVT. Tests must be submitted to and approved by Architect and Cypress-Fairbanks ISD Project Manager and Coordinator prior to installation.
- G. Cleaner: Neutral, chemical cleaner such as Hillyard "Super Shine-All" designed to be safe to use on any surface not damaged by water.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive resilient flooring, base, and accessories for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. Testing of concrete slabs
  - 1. Anhydrous Calcium Chloride Testing
    - a. Conduct anhydrous calcium chloride testing per ASTM F1869, modified to include testing over concrete containing lightweight aggregate.
    - b. Environmental requirements of area to be tested are to match that of the finished floor covering. Doors, windows, roofing, etc. must be installed and the temperature of the building controlled to a

finished building atmosphere. Ensure interior building climate is 75 degrees F  $\pm$  10 degrees F and 50% Relative Humidity  $\pm$  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 for 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.

C. Removal of existing vinyl composition tile:

1. Remove all furniture and appliances from the work area. Remove edge strips or other restrictive moldings from doorways, walls, etc. Before removal begins, vacuum the entire floor using a HEPA vacuum with a metal floor attachment. Remove resilient base using caution to prevent removing paint from walls.
2. Remove existing vinyl composition tile flooring using either the wet method or heat method in accordance with the Resilient Floor Covering Institute written instructions and recommendations. Legally dispose of removed vinyl composition tile offsite.
3. Residual adhesive must be wet-scraped so that no ridges or puddles are evident and what remains is a thin, smooth film. Apply ARDEX SD-P InstantPatch Self-drying, fast-setting, concrete underlayment patch to provide a smooth, steel-troweled surface acceptable to the flooring manufacturer.

### 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.
8. After floor tile has been installed, mark and cut out spaces for court striping and inlay accent color as striping. Insure that the factory applied top layer is not compromised.

#### B. Applying Rubber Base:

1. Install coved base after the floor tile, mat, and carpet have been laid. Do not use less than manufacturer's continuous rolls, except where required for last piece in any one run of wall length.
2. Apply base with adhesive covering 100% of the back surface, not just in spots. Apply adhesive with a notched trowel. Use headless brads in addition to adhesive where required. Use preformed outside corners and miter inside corners. Joints shall be tight.
3. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

### 3.4 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Repair or replace damaged surfaces that are soiled or scarred in a manner acceptable to the Owner.

### 3.5 CLEANING

- A. Clean in accordance with Section 01 74 13 - PROGRESS CLEANING.
  1. Remove excess adhesive and other foreign matter from tile flooring and base.
  2. Scrub floor with cleaner in conformance with manufacturer's instructions and rinse.
  3. Replace defective or loose material.

END OF SECTION

SECTION 09 65 43

LINOLEUM SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Homogeneous linoleum sheet flooring, adhesive and heat welded seams installation
- B. Related Sections:
  - 1. Section 09 65 00 - Resilient Flooring: wall bases, reducer strips, metal edge strips and other accessories

1.2 SUBMITTALS

- A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit manufacturer's standard color samples of tile, not less than 3" x 3", full thickness. Submit samples of each accessory, full height or width by not less than 2" length.
- B. Concrete Slab Testing
  - 1. Alkalinity and Adhesion Testing:
    - a. Submit result of pH tests.
    - b. Submit written documentation of acceptable pH levels of selected flooring manufacturer.
    - c. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.
    - d. Proceed with installation only after substrates pass testing.
  - 2. Relative Humidity Probe Tests:
    - a. Submit results for in situ relative humidity probe tests.
    - b. Submit date and time measurements were made.
    - c. Submit locations and depth of probe holes.
    - d. Submit temperature and relative humidity in each probe hole.
    - e. Submit ambient air temperature.
    - f. Acceptable relative humidity is typically 75% or less. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have relative humidity percentage stated as acceptable by manufacturer.
    - g. Submit letter from flooring manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
  - 3. Anhydrous Calcium Chloride Testing
    - a. Submit time and date of placement and retrieval.
    - b. Submit ambient air temperature and humidity during test duration
    - c. Submit manufacturer's instructions and relative technical data.
    - d. Acceptable moisture emission rates are typically 3 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 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.

1.4 PROJECT CONDITIONS

- A. Environmental Requirements: Material should be stored in areas that are fully enclosed, weathertight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 72 hrs. prior to, during and after installation.

## 1.5 MAINTENANCE

- A. Extra Materials:
  - 1. Furnish quantity of flooring units equal to 5% of amount installed.
  - 2. Upon completion of work, deliver to the project site materials from same production run as products installed.
  - 3. Enclose in protective packaging with appropriate identifying labels.
  - 4. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Resilient Sheet Flooring (Rf-01): Provide Marmoleum Sheet and Linoleum Adhesive as manufactured by Forbo Linoleum, Inc. and as scheduled; refer to Material Finish Schedule in Drawings.
  - 1. Description: Homogeneous sheet linoleum of primarily natural materials mixed and calendered onto natural jute backing. Pattern and color shall extend throughout total thickness of material.
  - 2. Width: 79".
  - 3. Length: 105 Linear Feet.
  - 4. Gauge: 1/8"
  - 5. Backing: Jute.
  - 6. Pattern and Color: As scheduled; refer to Drawings.
  - 7. Adhesive: Manufacturer's recommended adhesive.
  - 8. Heat Welding Rod: Marmoweld color-matched or multi-color welding rod as selected by Architect from manufacturer's full color range and pattern.
- B. Rubber Base: Reference Section 09 65 00 - Resilient Flooring.
- C. Edge Strips: 1" wide by 1/8" thick rubber tile reducer with beveled surface. Color as selected by Architect.
- D. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by linoleum manufacturer.
- E. Adhesive: Moisture-resistant type recommended by flooring manufacturer.
- F. Cleaner: Neutral, chemical cleaner such as Hillyard "Super Shine-All" designed to be safe to use on any surface not damaged by water.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive resilient flooring, base, and accessories for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.
- B. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- C. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- D. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- E. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

## 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  $\pm$  10 degrees F and 50% Relative Humidity  $\pm$  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 for 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. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Avoid organic solvents.

### C. Perform subfloor preparation as recommended by flooring manufacturer to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring.

- D. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.
- E. Concrete Moisture Test: Perform moisture tests on concrete floors regardless of the age or grade level with a minimum of three tests for the first 1000 square feet. The test shall be a calcium chloride test. One test shall be conducted for every 1000 sq. ft. of flooring. The test shall be conducted around the perimeter of the room, at columns and where moisture may be evident. The moisture emission from the concrete shall not exceed 5.0 lbs. per 1000 sq. ft in 24 hrs. For the most accurate results, the weight of the calcium chloride dish shall be made on the job site at the start and end of each test. A diagram of the area showing the location and results of each test shall be submitted to the Architect. If the test results exceed the limitations, the installation shall not proceed until the problem has been corrected.
- F. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.

### 3.3 INSTALLATION

- A. Laying Flooring:
  - 1. Adhesive Flooring Installation: Cut required length of linoleum flooring from roll, allowing enough material to extend up the wall 4 to 6 inches at either end. Layout and position sheet flooring so that any seams will fall at least 6 inches from underlayment joints or saw cuts in concrete substrate. Scribe and cut flooring material to shape of vertical surfaces, including walls and partitions. Apply adhesive and lay sheet flooring into wet adhesive and roll with a 100 pound roller. Install sheet flooring square with room axis.
  - 2. Adhesive, Seamless Flooring Installation: Rout out seams and heat weld together with complementary colored heat welding rod of complimentary composition in accordance with resilient flooring manufacturer's recommendations.
  - 3. Adhesive Material Installation: Use trowel as recommended by flooring manufacturer for specific adhesive. Spread at a rate of approximately 150 sq. ft./gal. (3.7 m<sup>2</sup>) as recommended by flooring manufacturer.
- B. Applying Rubber Base: Reference Section 09 6500 - Resilient Flooring.

### 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 68 00

CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Carpet, including the following:
  - 1. Surface preparation.
  - 2. Glue down carpeting on floor surfaces.
  - 3. Accessories, including edge strips.
- B. Related Sections:
  - 1. Section 09 65 00 - Resilient Flooring: rubber base.

1.2 SUBMITTALS

- A. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Include manufacturer's installation instructions.
- C. Concrete Slab Testing
  - 1. Alkalinity and Adhesion Testing:
    - 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.
- D. Samples for verification purposes in manufacturer's standard size, showing full range of color, texture, and pattern variations expected. Secure samples from material to be used for the work. Submit the following:
  - 1. 12" square samples of each type of carpet material required.
  - 2. 12" long samples of each type of exposed edge striping and accessory item.
- E. Seaming Diagrams: Submit to the Architect for review.
  - 1. Contractor shall be responsible for conformance with the drawings and specifications relative to the installation.
  - 2. Architect's review will cover the sizes of the pieces and location of seams, but not dimensions or quantities.
  - 3. All length seams and cross joints necessary to the layout of the carpet shall be shown on the seaming diagrams.



- F. Maintenance Manual: Provide 2 copies of a printed maintenance manual, written by the carpet manufacturer's Technical Service Department delivered to the Owner at the project site. Include the following:
  - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

### 1.3 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in carpet manufacturing with 5 years minimum experience.
- B. Installer Qualifications: An experienced installer with 3 years minimum documented experience in carpeting installations of similar scope.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Carpet shall be delivered to the project site in mill wrappings. Each roll shall have register number tags attached or register number stenciled on bale.
- B. Store materials for 3 days prior to installation in the areas of installation to achieve temperature stability.

### 1.5 PROJECT CONDITIONS

- A. Measurements: Dimensions supplied on the drawings are approximate. Contractor shall carefully check dimensions and other conditions affecting his work in the field and shall be responsible for proper installation.

### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Temperature and Humidity: Carpet must be installed when the indoor temperature is between 65°F. and 95°F. with a maximum relative humidity of 65%. If ambient temperatures are outside these parameters, the installation must not begin until the HVAC system is operational and these conditions are maintained at least 48 hours before, during, and 72 hours after completion.
- B. Provide sufficient lighting.

### 1.7 WARRANTIES

- A. Manufacturer's 25-year [10-year] [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): "Aftermath II #03026" with Synthetic Non-Woven backing manufactured by Tandus. Color and pattern as schedule; refer to Drawings. Carpet shall meet the following minimum requirements, NO EXCEPTIONS:
1. Construction: Tufted; patterned loop
  2. Face Weight: 17 oz./sq. yd.
  3. Gauge: 5/64".
  4. Density: 7,556 Per cubic yd. minimum (per ASTM D-5848).
  5. Face Yarn: 100% branded nylon, Type 6 or Type 6,6. 100% Bulk Continuous Filament (BCF)
  6. Stain Resistance: AATCC-175, must pass Acid Red 40 spot test with an 8 or better.
  7. Dye System: Solution dyed.
  8. Backing: 100% thermoplastic composite (no latex or urethanes). Backing system must provide a 100% moisture barrier.
  9. Width: 6-foot broadloom.
  10. 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. Substrate Filler: As recommended by adhesive and carpet manufacturer; compatible with substrate.
- C. Adhesive: As recommended by the carpet manufacturer.
- D. 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](http://www.burkeflooring.com)). Color(s) as selected by Architect.
- E. Miscellaneous Materials: Types of seam sealers, thread, and other accessory items recommended by the carpet manufacturer and installer for the conditions of installation and use.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Before commencement of work the Contractor shall inspect the floors to receive carpet to determine the condition of those surfaces and shall furnish and apply suitable primer and otherwise prepare floor surfaces in accordance with the carpet manufacturer's instruction.

### 3.2 PREPARATION

- A. Delay installation until surrounding work, including painting, has been completed. Vacuum substrate immediately prior to carpet installation and remove deleterious substances which would interfere with installation or be harmful to the work.
- B. Ensure floors are level, with maximum surface variation of 1/4 inch in 10 feet noncumulative. Inspect subflooring for cracks, holes, abrasions, rough spots, ridges, or other conditions which will adversely affect execution and quality of work.
- C. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity.
- D. Use an approved cementitious filler to patch cracks, small holes, and for leveling.
- E. Notify Architect in writing of conditions which will prevent satisfactory completion of work. Do not proceed until such defects are entirely corrected. Application or installation of carpet shall constitute acceptance of sub-floors.
- F. Relaxing/Conditioning Carpet: To minimize wrinkling and buckling, and to facilitate installation, carpet shall be unrolled and allowed to relax in the installation area for a minimum of 24 hours [72 hours (vinyl-back

carpet]] at a temperature between 65°F. and 95°F. Carpet must be adequately protected from soil, dust, moisture and other contaminants.

G. Testing of concrete slabs

1. Anhydrous Calcium Chloride Testing

- 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  $\pm$  10 degrees F and 50% Relative Humidity  $\pm$  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 for 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.

3.3 INSTALLATION

- A. Install carpet using the direct cement method.

1. Comply with carpet manufacturer's written instruction and recommendations. Maintain direction of pattern and texture throughout the entire building. Do not seam weft to warp, except as directed by Architect.
  2. Extend carpet under open-bottomed and raised-bottom obstructions, and under removable flanges of obstructions. Extend carpet into closets and alcoves of rooms indicated to be carpeted, unless another floor finish is indicated for such spaces. Extend carpet under movable furniture and equipment.
  3. Install carpet wall to wall, using continuous lengths and as broad widths as possible to minimize the placement of seams in traffic lanes. Cut edges shall be trued and appropriately treated to form invisible and non-raveling joints where exposed.
  4. Edges of carpet abutting vertical surfaces shall fit tight and meet against such materials. Where carpet edges are not concealed by thresholds or other materials use vinyl edge strips.
  5. In corridors, run carpet length parallel to the corridor walls. At corridor intersections, carpet shall change direction.
  6. Installed carpet shall be free of spots, dirt or soil, and shall be without tears, frayed or pulled tufts. Carpet surfaces shall be smooth and tight, without wrinkles and open seams.
- B. Check matching of carpet before cutting and ensure there is no visible variation between dye lots.
- C. Double-cut carpet seams, where required, in manner to allow proper seam and pattern match. Ensure cuts are straight and true and unfrayed.
- D. Seams
1. Install in accordance with approved seam layout using a minimum of seams. Where possible and practical, locate seams in areas of least amount of traffic.
  2. Do not use small carpet fill strips.
  3. Do not place seams perpendicular to doors or entries.
  4. Cross joints necessary due to layout of areas shall be at absolute minimum and shall be indicated on shop drawings.
  5. Cross joins necessary due to length of rolls received shall be placed, in the cutting, to avoid occurrence at conspicuous locations, near doors or at pivot points, and shall be approved prior to seaming.
  6. Join seams in recommended manner so as not to detract from the appearance of the carpet installation and decrease its life expectancy. Ensure seams are straight, not overlapped or peaked and free of gaps.
  7. Chemically or mechanically weld seams with manufacturer's recommended seam sealer as stated in installation instructions. Make sure the seams are fully sealed/welded.
  8. Roll with appropriate roller for complete contact of hardback carpet with mill-applied adhesive to sub-floor.
  9. When recommended by manufacturer, backing should be rolled according to manufacturer's instructions to assure transfer of the adhesive between floor and carpet backing.
  10. When required by the manufacturer's warranty, the manufacturer's recommended seam sealer must be applied to cut edges of carpet to prevent seam failure.
- E. Vacuum clean substrate. Spread adhesive in quantity recommended by manufacturer after primer application to ensure proper adhesion over full area of installation. Apply only enough adhesive to permit proper adhesion of carpet before initial set.
- F. Lay carpet on floors with the run of the pile in same direction of anticipated traffic. Lay carpet on stairs with run of the pile in opposite direction of anticipated traffic to avoid peeking of backing at nosing.
- G. Do not change run of pile in any one room or from one room to next where continuous through a wall opening.

### 3.4 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

### 3.5 PROTECTION

- A. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION

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SECTION 09 84 13

FIXED SOUND-ABSORPTIVE/SOUND-REFLECTIVE PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Acoustical wall panel system.

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 ACCEPTABLE MANUFACTURERS

- A. Acoustical Wall Panels: Provide acoustical wall panels as manufactured by one of the following:
- |                                        |                              |
|----------------------------------------|------------------------------|
| Armstrong World Industries.            | 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 Panels (AWP-01, AWP-02, AWP-03, AWP-04): Soundsoak Wall Panels as manufactured by Armstrong World Industries.
    - a. Panel Core: 6 to 7 pound per cubic foot fiberglass or mineral wool insulation board; or molded rigid fiberglass honeycomb panels with flat fiberglass faces.
    - b. Panel Fabric: As scheduled; refer to Drawings.
    - c. Panel Size and Thickness: 2" thickness and face dimensions as indicated.
    - d. Sound Absorption (ASTM C 423): Noise Reduction Coefficient (NRC) minimum value 0.85 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 12 00 - Structural Steel Framing: shop priming of structural steel.
  - 2. Section 05 21 00 - Steel Open Web Joist Framing: shop priming of steel joists.
  - 3. 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, unless noted otherwise.

1.3 SUBMITTALS

- A. Samples:
  - 1. Submit in accordance with SECTION 01 33 00 - SUBMITTALS.
  - 2. Submit two 8-1/2" x 11" samples of each paint color scheduled on the color schedule prepared by the Architect. Samples shall be on heavy cardboard and shall be made with the actual mixed paints to be used on the project.
  - 3. Samples for Initial Selection of each type of texture finish product.
- B. Paint Schedule: If painting materials other than those specified are proposed for use, submit a complete schedule of the materials to be substituted. This schedule, in triplicate, shall be in the same form as the paint schedule included in this section, and shall list materials by manufacturer, brand name, and type for each surface to be finished.
- C. Product Data: Submit data for each paint system specified.



- D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention.
- E. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
  - 1. Provide paint cards indicating the following, upon submission of extra materials at the end of the project:
  - 2. Project and area
  - 3. Manufacturer's stock number and date of manufacturer
  - 4. Contents by volume, formula for pigment and vehicle constituents
  - 5. Mixed by
  - 6. Color name and number
- F. 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.

#### 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 WARRANTY

- A. Two (2) years against becoming unserviceable or causing an objectionable appearance resulting from defective, nonconforming materials and workmanship.
  - 1. Defects shall include but not be limited to the following:
    - a. Discoloring noticeable by yellowing, steaking, blooming, changing color or darkening.
    - b. Mildewing
    - c. Peeling, cracking, blistering, alligatoring or releasing from substrate.
    - d. Chalking or dusting excessively
    - e. Changing sheen in irregular fashion
    - f. Softening or becoming tacky
    - g. Bubbling
  - 2. In the event of damage, immediately make all repairs and replacements necessary for approval of the Architect and at no additional cost to the Owner.

#### 1.6 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.

## 1.7 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain the temperature inside the building at not less than 60°F. during painting and finishing.
- B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 65°F. for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- C. Minimum application temperatures for latex paints: 45°F. for interiors; 50°F. for exterior; unless required otherwise by manufacturer's instructions.
- D. Minimum application temperature for varnish and finishes: 65°F. for interior or exterior, unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft.-candles measured mid-height at substrate surface.
- F. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified during application and drying periods of 24 hours between coats and 72 hours after final coat.
- G. Protection: Provide sufficient drop cloths to fully protect adjacent finished work.

## 1.8 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.

## 1.9 MAINTENANCE

- A. Extra Materials: Color cards with formula for each color used.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide paint as manufactured by one of the following:  
Basis of Design: The Sherwin-Williams Co. (<http://www.sherwin.com/default.asp>)  
PPG Industries (Pittsburgh Paints)
- 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: 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. Plaster and Gypsum wallboard: 12 percent.
  - 2. Interior located wood: 15 percent, measured in accordance with ASTM D 4442.
  - 3. Exterior located wood: 15 percent, measured in accordance with ASTM D 4442.
  - 4. Concrete Floors: 8 percent.
  - 5. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
- D. Test shop-applied primers for compatibility with subsequent cover materials.
- E. Perform the following Test procedure prior to painting. This will determine if Passivators exist on galvanized metal. This procedure is not necessary on galvanized metal with G 90 Paint Grip.
  - 1. Prepare a solution by dissolving 20 grams of copper sulfate in one liter (1000 grams) of water. Copper sulfate crystals may be purchased at most drug stores.
  - 2. Solvent wash a small area per the procedure of SSPC-SP1.
  - 3. Sand a small washed area using emery cloth.
  - 4. Using a cotton swab saturated with the copper sulfate solution, apply a swipe to both sanded and unsanded washed areas.
  - 5. If the sanded and unsanded surfaces turn black at the same time and that time is less than 10 seconds, there is no passivation on the surface other than light oil, and a normal degreasing/cleaning operation is sufficient preparation prior to the coating application. If the unsanded surface turns slower than the sanded surface, or not at all, a passivator of some type is present on the surface. If neither surface turns, the surface is probably an alloy of zinc or some other metal.
  - 6. If the galvanized steel has been treated or passivated, the treatment or passivator must be removed by brush blasting. If this method is prohibited by environmental regulations, then chemical etching with Amchem's GALVAPREP SG-3 will be acceptable, if previously approved by the Architect. The chemical etching manufacturer's procedures should be followed carefully.
  - 7. If the surface is determined to be an alloy by this test procedure, notify Architect and adhesion tests of the proposed coating applied over the proposed surface preparation must be conducted.
  - 8. If no passivators are present, wash galvanized metal surfaces with mineral spirits to remove residual grease and oil.
- F. Beginning of installation means acceptance of existing surfaces and substrate.

### 3.2 PREPARATION

- A. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions for each substrate condition.
- B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- C. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.
- D. Marks: Seal with shellac those which may bleed through surface finishes.
- E. Impervious Surfaces: Remove mildew by scrubbing with solution of (tetra sodium0 (tri-sodium) phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
- G. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Painting: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.
- H. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

- I. Concrete floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Copper Surfaces Scheduled for Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.
- K. Copper Surfaces Scheduled for Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.
- L. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- M. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- N. Concrete and Unit Masonry Surfaces Scheduled to Receive paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate, rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- O. Brick Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- P. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- Q. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- R. 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.
- S. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- T. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- U. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.
- V. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.
- W. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- X. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with clear sealer.
- Y. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.
- Z. Fill open joints, cracks and crevices on steel buck frames with metal putty and sand smooth before painting.
- AA. Sand woodwork surfaces smooth before priming.
- BB. Coat pine knots and pitch streaks with shellac before painting.

CC. Putty nail holes after the prime coat.

### 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.
- K. Finishing Mechanical And Electrical Equipment: Refer to mechanical and electrical standards for schedule of color coding and identification banding of equipment, duct work, piping, and conduit.

### 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 or portions of 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.
- 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 and work required for installation of mechanical and electrical work.

### 3.6 PAINT SCHEDULE

- A. The products listed below represent top of the line products of the manufacturer. Manufacturer's designation:  
SW The Sherwin-Williams Co.
- B. Interior Surfaces
1. Ferrous Metal
    - a. Primer – S/W DTM Bonding Primer (B66A00050)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  2. Galvanized Metal
    - a. Primer – S/W DTM Bonding Primer (B66A00050)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  3. Wood – Painted
    - a. Primer – S/W Premium Wall and Wood Primer (B28W8111)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  4. Wood – Stain
    - a. Stain – S/W Minwax Performance Series Tintable Wood Stain
    - b. Top Coat – S/W WoodClassics Waterborne Polyurethane Varnish Gloss (A68 Series)

OR the following Top Coat as selected by Architect

    - c. Top Coat – S/W WoodClassics Waterborne Polyurethane Varnish Satin (A68 Series)
  5. Gypsum Wallboard
    - a. Primer – S/W PVA Drywall Primer & Sealer (B28-8000 Series)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  6. Gypsum Wallboard – Kitchens
    - a. Primer – S/W PVA Drywall Primer & Sealer (B28-8000 Series)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  7. Concrete Masonry Units (CMU)
    - a. Primer – S/W Heavy Duty Block Filler (B42W46)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  8. Concrete Masonry Units (CMU) – Kitchens
    - a. Primer – S/W Heavy Duty Block Filler (B42W46)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  9. Concrete Floors
    - a. Primer – S/W ArmorSeal Floor Plex 7100 Primer (B70W / B70V)
    - b. Finish – S/W ArmorSeal 1K Waterbased Urethane Floor Enamel (B65-775 Series)
  10. Masonry/Concrete Ceilings
    - a. Primer – S/W Loxon Concrete & Masonry Primer Sealer (A24W8300)
    - b. Finish – S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-560 Series)
- C. Exterior Surfaces
1. Ferrous Metal
    - a. Primer - S/W DTM Bonding Primer (B66A00050)
    - b. Finish - S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
  2. Galvanized Metal
    - a. Primer - S/W DTM Bonding Primer (B66A00050)

- b. Finish - S/W Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)
- 3. Wood
  - a. Primer – S/W A-100 Latex Wood Primer (B42W41)
  - b. Finish – S/W A-100 Exterior Latex Satin (A8 Series)
- 4. Concrete and CMU
  - a. Primer – S/W Loxon XP Waterproofing Coating (A24-1400 Series)
  - b. Finish - S/W Loxon XP Waterproofing Coating (A24-1400 Series)
- OR
- c. Finish – S/W Loxon Self-Cleaning Acrylic Coating (LX 14-50 Series)
- 5. Fiber-Cement Material
  - a. Primer – S/W Loxon Concrete & Masonry Primer Sealer (A24W8300)
  - b. Finish – S/W A-100 Exterior Latex Satin (A8 Series)
- 6. Parking Lot Lines
  - a. SetFast Acrylic Latex Traffic Marking Paint (TM21 Series)
  - b. Colors
    - 1) YELLOW for Parking Stripes
    - 2) RED for Fire Lanes with WHITE Lettering
    - 3) WHITE for Band Practice Field striping
    - 4) BLUE and WHITE for Handicap Parking symbols
- 7. Handicap Ramps
  - a. S/W ConFlex Flexible Concrete Waterproofer – Textured
  - b. Color
    - 1) SW 0006 TOILE RED for Ramps

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.
  - 3. Section 09 72 16 - Vinyl-coated Fabric Wall Covering.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements:
  - 1. Reflectivity: Not to exceed specified range when tested at 60 degrees with a gloss meter in accordance with ASTM C 523.
  - 2. Contrast for marker boards (Light and Dark Effects): not more than 11.7 when tested with a BYK-Gardner Wave Scan 5+ Measurement Device showing visual acuity to the human eye at distances greater than 10 feet.

1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Product Data: Include complete manufacturer's catalog cuts and data sheets of anchors, fasteners, color chips (photographic reproductions are not acceptable) and installation requirements.
- C. Shop Drawings:
  - 1. Include types of units provided, location within each room, and length of each unit.
  - 2. Include dimensioned elevation drawings of each board assembly indicating joint locations and type of joint where required, and board mounting distances from floors.
  - 3. Include cross-section details showing each type of product and components; trim, face, core, backing materials and thickness, and key to elevations.
  - 4. Show anchorage details.
  - 5. Show installation details.
- D. Samples: Submit a 12" x 12" sample of each type of markerboard and tackboard. Submit a 6" long sample of each component of exposed trim.
- E. Quality Control Submittals:
  - 1. Test Reports: Copies of test reports, from certified testing agency, verifying that products have been tested and meet the specified performance requirements.
  - 2. Manufacturer's Instructions: Installation instructions for all products specified.

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): Provide projectable porcelain enamel steel liquid chalk writing system, 4'-0" height by length indicated. Product/ manufacturer; one of the following:  
LCS<sup>3</sup> 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 staves, both G and F clefs.
    - b. Colors as selected by Architect.
- B. Glass Markerboards: Provide MGM Glass Markerboards and brushed stainless edge grips for stand-off mount as manufactured by Claridge Products and Equipment, Inc.
1. 1/4" tempered, low-iron, extra clear, safety writing glass with polished edges
  2. Back-painted with specially formulated fade resistant, water resistant, and heat resistant paint in color as selected by Architect.
- C. 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.
- D. 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
- E. 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.
- F. Map Rails: 1" wide of extruded aluminum with cork insert and Claridge No. 51ES type end stops. Furnish one No. 51M metal map hook for each linear foot of map rail and two No. 51FH flag holders for each room with map rails. Finish map rail to match the markerboard frames."
- G. Chalktroughs: Heavy tubular type of extruded aluminum with cast aluminum end caps, finished to match the markerboard frames.
- H. Adhesive: Flash-proof type furnished or recommended by the manufacturer.
- I. 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. Retro-Fit Markerboard Installation:
    - a. Using an adhesive that is suitable for Retro-fit panel installation, apply adhesive behind each fixed board using egg sized gobs at 16 inches on center.
    - b. Install factory supplied flat head screws for all factory drilled holes in trim. Avoid installing screws at an angle. Seat screws flat in countersunk holes. Screws with burrs or raised edges will not be accepted.
  5. Behind the tackboards furnish and field install suitable blocking pads 16" o.c. each way to prevent bowing.
  6. Behind pegboards, field install blocking pads at 16" on centers.
  7. The installed boards shall be flat, plumb, square and rigid.
  8. Mounting Height: From finished floor to bottom of chalkrail or bottom of tackboard shall be:  
Kindergarten / Pre-Kindergarten - 24"  
Elementary - 30"  
Intermediate (4th and 5th) - 32"  
Junior High / Middle School - 36"

Senior High - 36"  
Adult-only Locations - 36"

B. Erecting Exhibit Rails/Tack Strips:

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.

3.3 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

SECTION 10 12 00

DISPLAY CASES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Display cases.
- B. Related Sections:
  - 1. Division 26 - Electrical; rough-in for light fixture.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases.
  - 2. Include furnished specialties and accessories.
  - 3. Include installation instructions.
- C. Shop Drawings:
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show location of seams and joints in tackboard panels.
  - 3. Include sections of typical trim members.
  - 4. Include diagrams for wiring of illuminated display cases.
- D. Samples: Submit a 12" square sample of tackboard material and a 12" length of trim.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Display Case (DC-01, DC-02): Provide 900 DC Series display cases as manufactured by The Tablet and Ticket Co. Equivalent products of one of the following will be acceptable:
  - Claridge, Inc.
  - A-1 Visual Systems
  - Nelson-Harkins Industries
  - Poblocki Sign Company
  - 1. Provide in sizes as shown by Drawings.
  - 2. Field verify opening for display cases.
  - 3. Provide manufacturer's optional fully recessed LED light fixtures.

2.2 MATERIALS

- A. Aluminum Extrusions: Provide manufacturer's standard extruded aluminum sections of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5 alloy.
- B. Glass: Provide clear, tempered safety glass complying with the requirements of ASTM C 1048, Type I, Kind FT, Condition A, Class 1 - transparent.
- C. Shelves: Clear tempered safety glass, 1/4 inch thickness and supported by brackets.
- D. Tackboard: Provide seamless sheet, 1/4" thick ground natural cork compressed with a resinous binder with washable vinyl finish and integral color throughout, laminated to burlap backing. Provide color and texture as selected by Architect.

- E. Fasteners: Provide screws, bolts, and other exposed fastening devices of the same material as the items being fastened. Use theft-proof fasteners.
- F. Glazed Sliding Doors: 3/16" thick tempered glass, framed, with extruded aluminum frame; supported on ball-bearing rollers.
  - 1. Lock: Furnish each cover with the manufacturer's standard lock; key all locks alike. Furnish 2 keys per lock.

## 2.3 FABRICATION

- A. General: Fabricate display cases to comply with dimensions, design, and details, and quality indicated.
- B. Fabricate perimeter and cover frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.
- C. Hardware for Covers: Equip covers with the manufacturer's standard hardware of the type indicated.
- D. Provide the manufacturer's standard recessed display cases, fabricated to sizes indicated, consisting of the display case housing with perimeter frame, sides and back, tackable surface, and operable transparent covers with hardware.
- E. Perimeter Frame and Cover Design: Provide extruded aluminum perimeter frame of profile indicated. Provide extruded aluminum door frame of the profile indicated, glazed with 3/16" thick clear tempered glass.
- F. Finish: Class II, Clear Anodic Finish, AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating) complying with AAMA 611.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units plumb, and level, in locations shown. Securely attach to the supporting structure with concealed fasteners, in accordance with the manufacturer's installation instructions.

### 3.2 CLEANING AND PROTECTION

- A. Upon completion of installation, clean surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Architect.

END OF SECTION

## SECTION 10 14 00

### IDENTIFYING DEVICES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior room identification signs.
  - 2. Exterior room identification signs.
  - 3. Post and panel site signs.
  - 4. Vinyl Adhesive Letters at Storefront
- B. Related Sections:
  - 1. Section 01 21 00 - Allowances.

##### 1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: Submit manufacturer's complete line of color samples, 1" x 3", for initial color selection.
- C. Invoices: Submit certified copies of invoices indicating description and quantity of signs delivered and installed.
- D. Template: Submit full-size template drawing for approval:
  - 1. Aluminum letter size, stock, spacing, anchorage devices, etc.
  - 2. Building Dedication Plaque.

##### 1.3 PRE-INSTALLATION CONFERENCE

- A. Pre-installation Meeting: Contractor shall schedule a pre-installation meeting at the project site with the Architect, Contractor and building letter installer for approval of template field layout prior to beginning of installation.

##### 1.4 QUALITY ASSURANCE

- A. Interior signs shall be provided by a single source with at least five years' experience successfully providing signs of similar type and scope.
- B. Signs shall comply with the Texas Accessibility Standards (TAS) and other laws and ordinances of authorities having jurisdiction. Braille shall be Grade II, having dimensions as required to meet TAS.

##### 1.5 PACKING, DELIVERY, AND STORAGE

- A. Deliver components correctly packaged to prevent damage. Pack modules and back-up plates unassembled to allow for mechanical mounting of backplate to wall with concealed fasteners.
- B. Individually and clearly identify each sign number, type, location to be installed, mounting instructions, and other pertinent information.

#### PART 2 - PRODUCTS

##### 2.1 INTERIOR IDENTIFICATION GRAPHICS

- A. Provide room identification signs as indicated in the attached INTERIOR IDENTIFICATION DEVICES SCHEDULE.

- B. "InTouch" photopolymer plaque signs as manufactured by ASI Sign Systems, Inc. (8181 Jetstar Drive, Suite 100, Irving, Texas, 75063) or approved equivalent.
  - 1. Manufacture face panels utilizing an 1/8" integral photopolymer panel.
  - 2. Face panel tactile and Grade 2 Braille graphics shall be raised a minimum of 1/32".
  - 3. Treat the face panel to assure paint adhesion.
  - 4. Colors to be selected by Architect to meet ADA requirements for contrast.
  - 5. Characters and background of signs shall have eggshell, non-glare finish.
  - 6. Sign edges shall be painted to match background.
  - 7. Sign edges are to be smooth and free of saw marks and imperfections.
  - 8. Sign design shall be as indicated on drawings.
  - 9. Typeface shall be Helvetica Medium.
  - 10. Lettering shall be computer generated, accurately reproducing the letterform.
  - 11. Provide matching coverplate for signs mounted on glass.

## 2.2 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.
  - 2. Face panel tactile and Grade 2 Braille graphics shall be raised a minimum of 1/32".
  - 3. Colors to be selected by Architect to meet ADA requirements for contrast.
  - 4. Sign edges are to be smooth and free of imperfections.
  - 5. Sign design shall be as indicated on drawings.
  - 6. Typeface shall be Helvetica Medium.
  - 7. Lettering shall be computer generated, accurately reproducing the letterform.

## 2.3 POST AND PANEL SIGN

- A. Provide post and panel signs as selected by Architect by allowance.
- B. Basis of Design: Provide "Compass" Exterior Post and Panel Sign System as manufactured by ASI Sign Systems, Inc. Equivalent signs by the following manufacturers will be acceptable:
  - APCO Architectural Signs
  - ASI Sign Systems
  - Tablet & Ticket Co.
  - 1. Post and panel signs as shown on drawings.

## 2.4 EXTERIOR VINYL ADHESIVE LETTERS

- A. Vinyl Adhesive Letters:
  - 1. Provide 2-mil thick, moisture resistant, electronic cut and thermal transfer Scotchcal™ ElectroCut™ Graphic Film Series 7725 or approved equivalent.
  - 2. Provide letters/numbers at each building entry in number/letter configuration as on drawings.
  - 3. Provide letters/numbers in location near entry as shown on drawings.
  - 4. Provide 7-year warranty.
  - 5. Color as selected by Architect.
  - 6. Size: 1 inch x 6 inches

## 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. Post and Panel Sign: Install signs in strict compliance with manufacturer's instructions.

D. Marquee Sign: Install marquee sign in strict compliance with manufacturer's instructions.

E. Vinyl Adhesive Letters: Install letters 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 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Plastic toilet compartments and urinal screens.
- B. Related Sections:
  - 1. Section 05 50 00 - Metal Fabrications: supports for floor-to-ceiling [ceiling-hung] compartments.
  - 2. Section 06 10 00 - Rough Carpentry: wood blocking for bracket attachments.
  - 3. Section 10 28 00 - Toilet Accessories.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 00 - SUBMITTALS.
- B. Product Data:
  - 1. Submit complete manufacturer's catalog cuts and data sheets with installation requirements supplied. Include finish and installation requirements for hardware, anchors and fasteners.
  - 2. Submit literature documenting that the compartment door latch meets Texas Accessibility Standards (TAS) requirements.
- C. Shop Drawings: Include drawings for fabrication and erection of toilet compartment assemblies which are not fully described in manufacturer's data.
- D. Samples: Submit a 6" x 6" sample. Photographic reproductions of color are not acceptable. Submit samples of each type of hardware used.

1.3 WARRANTY

- A. Submit manufacturer's standard 15-year warranty against breakage, delamination, and corrosion.

1.4 QUALITY ASSURANCE

- A. Manufacturers must have a minimum of five (5) years' experience manufacturing products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

2.2 ACCEPTABLE MANUFACTURERS

- A. Toilet Compartments; Floor-Mounted, Overhead-Braced:  
Standard HDPE; Scranton Products (Santana/Comtec Ind./Capitol Partitions) (No substitution)
- B. Urinal Screens; Wall Hung:  
Wall Mounted Urinal Screens; Scranton Products (Santana/Comtec Ind./Capitol Partitions)

2.3 MATERIALS

- A. Panels, doors, and pilasters shall be fabricated from High Density Polyethylene (HDPE) manufactured under high pressure to form a solid homogeneous sheet one-inch thick with a textured gloss finish. Color(s) shall be as selected by Architect.
  - 1. Color: Black Paisley (No substitution).
  - 2. Panels and doors shall have aluminum heat-sink fastened to bottom edges utilizing vandal-proof stainless steel fasteners.

- B. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel of one-piece construction, 3" high, finish to match hardware.
- C. Headrails: Extruded, polished anodized aluminum in anti-grip profile.

## 2.4 FABRICATION

- A. Fabricate compartments with all edges machined to a radius of 0.250" with all sharp corners removed. Machine for hardware at the factory. Seal all plastic surfaces with protective film.
- B. Fabricate flush compartment panels, pilasters and doors to the layout indicated with the following minimum dimensions.
  - 1. Where grab bars are indicated, provide a min. 32" wide (clear opening) out-swinging door.
  - 2. At other locations, standard compartments shall have a 24" wide in-swinging door unless specifically detailed and dimensioned otherwise.
  - 3. Doors and compartments panels 55" in length with a 13-1/2" clearance between floor and bottom of panels and doors. Pilasters shall be floor mounted, overhead braced, 82" high.
  - 4. Edging Strips: Provide continuous aluminum heel sink strips fastened with vandal-proof stainless steel fasteners to bottom edge of all doors and panels.
  - 5. Urinal screens 24" by 42" high.
- C. Hardware: Provide hardware and fittings for compartment system of chrome-plated cast non-ferrous metal alloy, chrome-plated brass, or polished stainless steel. Stirrup brackets only may be heat-treated extruded aluminum with bright anodized finish.
  - 1. Hinges: Adjustable to permit doors to be set either self-opening or ajar. Hinges shall be 8" and fabricated from heavy-duty extruded aluminum (6463-T5 alloy) with bright dip anodized finish with wrap-around flanges, through bolted to doors and pilasters with stainless steel, torx head sex bolts.
  - 2. Hinges: Hinges: Full length extruded aluminum in bright dip anodized finish or 14 gauge stainless steel continuous piano hinge. Hinges shall be fastened with stainless steel screws.
  - 3. Latches: Heavy-duty extruded aluminum (6463-T5 alloy) and provision for emergency access and paddle handle on accessible stalls in compliance with the ADA. Latch housing shall have bright dip anodized finish.
  - 4. Strikes and Keepers: Wrap-around type with rubber bumper, mounted with through bolts.
  - 5. Coat hooks with rubber bumpers for in-swinging doors.
  - 6. Pulls: Provide pulls adjacent to the latch on both sides of the toilet partition door. Furnish with wall bumpers where required to prevent doors from striking wall.
  - 7. Brackets: Heavy duty aluminum (6463-T5 alloy) two-eared stirrup brackets, one-eared brackets at corners. The use of U-type brackets is not acceptable.
  - 8. Brackets: Heavy duty aluminum (6463-T5 alloy) full length continuous wall brackets.
  - 9. Fasteners: Vandal proof (one-way) screws and sex bolts of chrome-plated brass or stainless steel for all exposed locations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, soundness of wall surfaces, location of built-in framing/anchorage/bracing, and other conditions that would affect proper installation of holding brackets and anchorage or suspension devices.
- B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

### 3.2 INSTALLATION

- A. Install compartments and urinals, rigid, straight, plumb and with horizontal lines level. Drilling, cutting and fitting to room finish shall be concealed in the finished work. Clearance at vertical edges of doors not to exceed 3/16-inch and shall be uniform from top to bottom. Doors shall be free of warp and wind.  
Attach dividing compartments to the back wall with continuous wall brackets and at the front to the pilasters with the same type brackets. The use of U-type brackets is not acceptable.
  - 1. Attach dividing compartments to the back wall and front to pilasters with continuous wall bracket.
  - 2. Attach overhead braces to walls with heavy saddle-type brackets.

3. Attach pilasters to floor with No. 5 plastic anchors and No. 14 stainless steel phillips head screws. Level, plumb and tighten the installation with the leveling device. Conceal the floor anchorage and bases with pilaster shoe assembly having concealed snap-down action on a concealed hold-down clip. Exposed fasteners on shoe will not be permitted.
4. Provide a 13-1/2" clearance between floor and bottom of compartment panels and doors.
5. Clearance of vertical edges of doors shall be uniform top to bottom and shall not exceed 3/16 inch.

### 3.3 ADJUST AND CLEAN

- A. Adjusting: Adjust hardware just prior to final acceptance. Doors shall operate freely.
  1. For out-swinging doors, adjust hinges to hold doors closed.
  2. For in-swinging doors, adjust hinges to hold doors open at 30°.
- B. Cleaning: Remove protective masking and clean surfaces, leaving them free of soil and imperfections.

END OF SECTION

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## SECTION 10 26 13

### CORNER GUARDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Corner guards.
- B. Related Sections:
  - 1. Section 04 20 00 - Unit Masonry: concrete masonry units.
  - 2. Section 09 21 16 - Gypsum Board Assemblies: gypsum board walls.
  - 3. 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 clear corner guards.
- B. Provide manufacturer's limited lifetime warranty against material and manufacturing defects on stainless steel corner guards

#### PART 2 - PRODUCTS

##### 2.1 CORNER GUARDS

- A. Cement-On Guards: Provide 4'-0" long Type 430, 18-gage stainless steel corner guards, 90°, 1/8" radius, 3½" wing as manufactured by Tubular Specialties Mfg. (800.472.2227, www.calltsm.com). Mounted with Premium Adhesive. Standard Styles shall be as follows:
  - 1. CP-3548 - 4'-0" long.
  - 2. EW Series for End Wall Guards - 4'-0" long x field measurement of web.
  - 3. CP-Z2 Series Built-In Corner Guards at ceramic tile corners.
- B. Stainless Steel Corner Guards: Provide corner guards as manufactured by shall be manufactured from Type 304 (meets NSF Standard 51), 16 gauge, #4 Satin Finish, 90°, 1/8" radius, or degree/radius necessary for applicable corner, with 3 inch wings, 8 foot length. Fasteners shall be pre-drilled beveled holes and Phillips head screws. Provide one of the following products/manufacturers:
  - 1. IPC Door and Wall Protection Systems; InPro Corporation
  - 2. Korogard, Koroseal Wall Protection Systems; Division of RJF International Corp.
- C. 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 or equivalent products approved by Architect manufactured by RJF International Corporation: Korogard or Pawling Corporation.

#### 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. Kitchen: Cement on stainless steel corner guards shall be installed at all outside corners. Surface mounted stainless steel corner guards shall be applied with manufacturer supplied adhesive. Tops of corner guards in kitchen shall be sealed with clear silicone sealant.
  - 2. Drywall Hallways: Install screw on stainless steel 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

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Toilet and Janitor accessories.
- B. Related Sections:
  - 1. Section 09 21 16 - Gypsum Board Assemblies
  - 2. Section 09 30 13 - Ceramic Tiling
  - 3. Section 10 21 15 - Plastic Toilet Compartments

1.2 SUBMITTALS

- A. Submit the following according to Section 01 33 00 – *Submittals*:
  - 1. Product Data: Manufacturer's complete product information and installation instructions for each toilet accessory.
  - 2. Installation Drawings: Include templates, instructions and directions for installation of anchorage devices.
  - 3. Samples: Fasteners proposed for use for each type of wall construction.

1.3 QUALITY ASSURANCE

- A. Products: Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.
  - 1. Stamped names or labels on exposed faces of units will not be permitted.
  - 2. Provide locks where specified, with the same keying for all accessory units in the project.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Wrap toilet accessories for shipment and storage and deliver to the Project Site in Manufacturer's original packaging. Store accessories in a clean, dry area protected from construction damage and vandalism.

1.5 WARRANTY

- A. Provide Manufacturer's written 10-year limited warranty for hand dryers.

1.6 COORDINATION

- A. Accessibility Standards: Coordinate accessory locations with other work to prevent interference with clearances required for access under Texas Accessibility Standards (TAS), Architectural Barriers Act--Article 9102, Vernon's Texas Civil Statutes and Texas Government Code, Chapter 469.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toilet accessories shall be of the quality manufactured by Bobrick Washroom Equipment, Inc. and are listed by Bobrick catalog numbers for convenience in identification. The use of a catalog number as a description of an item shall be taken to include the description or specification for the item in the manufacturer's catalog.
- B. Toilet Accessories: Equivalent items of the following manufacturers are acceptable:
  - American Specialties, Inc.
  - Bradley Corp.
  - General Accessory Manufacturing Co. (GAMCO)
  - McKinney/Parker Washroom Accessories Corp.
- C. Warm-air Hand Dryers: Provide one of the following; NO SUBSTITUTIONS:
  - Saniflow M06AF-UL
  - Bradley 2902-280000-120V

TOILET ACCESSORIES

10 28 00 - 1



## 2.2 BASIC MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304 with No. 4 satin finish.
- B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30 castings.
- C. Sheet Steel: ASTM A 1008, cold rolled, commercial quality.
- D. Galvanized Steel Sheet: ASTM A 653, G60 (Z180).
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electro-deposited on base metal.
- F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q3, nominal 1/4-inch thick, with silvering, electroplated copper coating, and protective organic coating complying with ASTM C 1036.
- G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- H. Fasteners:
  - 1. Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction.
  - 2. Provide screws, bolts, and other fastening and anchoring devices of same material as the accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
- I. Hinges: Full length stainless steel piano hinges.
- J. Keys: Provide universal keys for access to accessories for servicing and resupplying. Provide minimum of six keys.

## 2.3 ACCESSORIES

- A. Toilet Tissue Dispensers (A): Owner-Furnished Contractor-Installed
- B. Grab Bars (B): Model B-6806, 48 inches
- C. Grab Bars (C): Model B-6806, 42 inches
- D. Mirrors (D): Model B-290 2436.
- E. Paper Towel Dispenser/Waste Receptacles (E): Owner-Furnished Contractor-Installed.
- F. Sanitary Napkin Disposal Units (F): Model B-270.
- G. Soap Dispensers (G): Owner-Furnished Contractor-Installed
- H. Warm Air Hand Dryers (H): Saniflow M06AF-UL or Bradley 2902-280000-120V, surface mounted, automatic operation. Color to be selected by Architect.
- I. Custodian's Utility Shelves (J): Model B-224 x 36 inches, one per Custodian's Closet and where otherwise scheduled.
- J. Robe Hooks (M): Model B-211.
- K. Baby Changing Station (P1): Model KB110-SSRE baby changing station by Koala Kare Products.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Coordinate accessory manufacturer's mounting details with other trades as their work progresses.

- B. Install accessories according to Manufacturers' written instructions and recommendations. Install units level, plumb, and firmly anchored in locations and at heights indicated. Adhesive mountings and plastic rawl plug mounts will not be acceptable.
  - 1. Recessed Accessories:
    - a. Set anchors in mortar in masonry construction.
    - b. Fasten to metal studs or framing with sheet metal screws.
  - 2. Surface Mounted Accessories:
    - a. Mount on concealed backplates unless specified otherwise. Mount accessories that do not have backplates using concealed fasteners.
    - b. Install accessories with sheet metal screws or wood screws in lead-lined braided jute, PTFE or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner or provide with lugs or anchors set in mortar, as required by the construction.
    - c. Fasten accessories mounted on gypsum board walls without solid backing into the metal studs, or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.
- C. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square.
- D. Install accessories at the location and height indicated. At toilets with wheelchair compartments, install toilet accessories so that height above finished floor at operating areas such as coin slots, pushbuttons, openings for towels, cups and waste comply with TAS requirements.
- E. Attachment:
- F. Attach dispensers and cabinets to steel stud partitions with suitable hollow wall screw anchors.
  - 1. Attach dispensers and cabinets to masonry partitions with stainless steel expansion shields and machine screws.
  - 2. Attach sanitary napkin disposal units and toilet tissue dispensers to toilet partition panels with stainless steel or chrome plated through bolts and hex cap nuts.
  - 3. Attach sanitary napkin disposal units and toilet tissue dispensers to toilet partition panels with stainless steel or chrome plated through bolts and hex cap nuts.
- G. Install grab bars to withstand a downward load of at least 250 lbf. Attach grab bars to toilet partition panels with stainless steel through bolts and plated hex cap nuts. Attach grab bars to steel stud partitions with connector assemblies to steel anchors fastened to studs. Attach grab bars to masonry partitions with stainless steel expansion shields and machine screws.
- H. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean material according to Manufacturer's recommendations. Do not use alkaline or abrasive cleaning agents. Take precautions to avoid scratching and marring of exposed surfaces.

END OF SECTION

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SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fire extinguishers and fire extinguisher cabinets.

1.2 DEFINITIONS

- A. Where indicated on the drawings the abbreviation "F.E.C." defines a fire extinguisher and cabinet and the abbreviation "F.E." is for fire extinguisher without cabinet.

1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Include physical dimensions, operational features, color and finish, anchorage details, material descriptions and type of hardware.
- C. Shop Drawings: Include rough-in measurements, locations, and details for cabinets.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.
- B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain products in this Section from one manufacturer.
- B. Certifications
  - 1. Provide extinguishers which are U.L. listed and bear the U.L. "Listing Work" for type, rating, and classification.
  - 2. Conform to NFPA-10 requirements for extinguishers.
  - 3. Provide units conforming with ANSI/UL 711.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- B. Store extinguishers in protected location until after final cleaning is completed.

1.7 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Do not store products subject to freeze damage in environments where damage could occur.

## PART 2 - PRODUCTS

### 2.1 FIRE EXTINGUISHERS

- A. Provide multi-purpose dry chemical type fire extinguisher, 10 lbs. nominal capacity. Provide manufacturer's standard hook type bracket where fire extinguishers are noted without cabinets. Product/manufacturer; one of the following:
  - Cosmic 10E; J.L. Industries, Div. of Activar, Inc.
  - MP10; Larsen's Manufacturing Co.
  - Wing 10HB; Modern Metal Products
  - Model 3010; Potter-Roemer
- B. At Kitchen provide wet chemical type fire extinguisher with a Class K UL rating. Provide manufacturer's standard wall mounting bracket. Product/manufacturer; one of the following:
  - Saturn 15 Model, JL Industries, Inc., Div. of Activar, Inc.
  - WC-6L Series Wet Chemical, Larsen's Manufacturing Co.
  - 3260; Potter-Roemer/B260; Amerex

### 2.2 FIRE EXTINGUISHER CABINETS

- A. Provide stainless steel trim and door. Doors shall be solid with vertical window and have continuous piano hinge. "Fire Extinguisher" vertical ascending silk-screened lettering in red. Product / manufacturer; one of the following:
  - Fire-FX 1037V10 Cosmopolitan; J.L. Industries, Div. of Activar, Inc.
  - FS SS2409-R4 Vertical Duo, Acrylic; Larsen's Manufacturing Co.
  - "Alta" Series No. 7063-DV-6; Potter-Roemer.
- B. Recessed solid flush panel door with vertical ascending silk-screened lettering, no stick-on lettering, cold rolled steel with electrostatically applied, thermally fused polyester coating with recoatable white finish. Standard chrome plated handle with roller catch. Size as required by size of fire extinguisher furnished for project. Provide appropriate mounting brackets and signage.
  - "Embassy" Series No. 5614S21; J.L. Industries, Div. of Activar, Inc.
  - "Occult" Series No. O-2409; Larsen's Manufacturing Co.
  - "100" Series No. 1026R1; Modern Metal Products, Div. of Technico, Inc.
  - "Dana" Series No. 7220 F-VAB; Potter-Roemer

### 2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for type and capacity of fire extinguisher indicated, with plated or baked-enamel finish. Color shall be red.
- B. Identification: Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface. Orientation shall be horizontal.

### 2.4 FABRICATION

- A. Form body of cabinet with tight inside corners and seams.
- B. Predrill holes for anchorage.
- C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.
- D. Hinge doors for 180° opening with continuous piano hinge. Provide nylon roller type catch.

### 2.5 FINISHES

- A. Extinguisher: Red enamel.
- B. Cabinet Trim and Door: Stainless Steel.
- C. Cabinet Interior: White enamel.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install fire extinguisher cabinets at locations indicated in accordance with the manufacturer's instructions. Install level, plumb, secure. Install fire extinguisher cabinets with operable part of extinguisher at 48" above finished floor.
- B. Install fire extinguishers within cabinets on mounting brackets, placed in such a manner that operating instructions face outward.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb. Apply identification decals above bracket-mounted fire extinguishers.
- D. Service, charge (if required), and tag each fire extinguisher not more than five calendar days prior to substantial completion.
- E. Maintain design of fire-rated partitions associated with cabinets.

END OF SECTION

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## SECTION 10 51 13

### METAL LOCKERS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Metal lockers.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-in-Place Concrete; concrete base.
  - 2. Section 06 10 00 - Rough Carpentry; wood sleepers and wood blocking.
  - 3. Section 09 65 00 - Resilient Flooring; rubber base.

##### 1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit complete manufacturer's catalog cuts and data sheets of hardware, anchors, fasteners and installation requirements.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show flat tops, filler panels, end panels, and other accessories. Include locker identification system.
- D. Samples: Submit color chips (photographic reproductions of color are not acceptable).

##### 1.3 QUALITY ASSURANCE

- A. Uniformity: Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

##### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.
- B. Store and protect lockers under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- C. Protect locker finishes and adjacent surfaces from damage during installation.

#### PART 2 - PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. General Lockers: Materials and methods described are based on the specifications of Penco Products, Inc. ([www.pencoproducts.com](http://www.pencoproducts.com)) and are given to designate the quality of materials and workmanship required. Equivalent lockers as manufactured by one of the following will be acceptable:
  - Art Metal Products, Div Fort Knox Storage Co. ([www.artmetalproducts.com](http://www.artmetalproducts.com))
  - List Industries, Inc. ([www.listindustries.com](http://www.listindustries.com))
  - Lyon Metal Products, Inc. ([www.lyonmetal.com](http://www.lyonmetal.com))

##### 2.2 STANDARD LOCKERS (TYPE A)

- A. Materials: Sheet metal shall be smooth cold-rolled steel, ASTM A 1008, at least 16 gage for doors and frames and 24 gage for bodies. Nuts and bolts shall be cadmium plated.
- B. Construction: Doors shall be louvered and adequately flanged at edges. Door frames of channel shapes shall be securely welded together. Provide continuous door strikes at jambs. Provide rubber silencers on each latching hook. Fabricate to swing 180°.
  - 1. Ventilation: Provide stamped, louvered vents in door face, as follows:
    - a. Six-tier Lockers: Not less than 6 louver openings in each door.
  - 2. Hinges: Heavy-duty, not less than 0.050" thick steel, full-loop, 5 knuckle, tight pin, 2" high. Provide at least 2 hinges for each door 42" high or less.



- C. Locks:
  - 1. Recessed handle with provisions for Owner-furnished padlocks.
  - 2. Provide handicapped accessible latches on accessible lockers.
- D. Trim: 16 gage steel filler strips to cover spaces between lockers and adjacent walls at ends of rows and elsewhere as may be required. Provide finished end panels (no holes) for exposed ends of locker rows. Finish trim to match lockers.
- E. Equipment: Furnish each locker with the following items.
  - 1. Six-tier Lockers:
    - a. Side hinged door.
    - b. At handicapped accessible lockers
      - 1) handle with locker or hasp must be no higher than 48" from finish floor, and
      - 2) locker bottom must be a minimum of 15" from finish floor.
- F. Flat Tops: not less than 24-gauge sheet steel, in lengths as long as possible. Provide closures at ends. Finish to match exterior of lockers.
- G. Finish:
  - 1. Chemically pre-treat metal with degreasing and phosphatizing process.
  - 2. Enamel powder coat paint finish electrostatically applied, baked, and properly cured to manufacturer's specifications for optimum performance.
  - 3. Finishes containing volatile organic compounds and subject to out-gassing are not acceptable.
  - 4. Color: Lockers shall be one custom color exterior and shall be manufacturer's standard color interior. Colors as scheduled in Material Finish Key on drawings.
- H. Number Plates: Aluminum with black filled numbers, fastened with rivets to the top of the front face of the locker door, not in the recess. Number lockers consecutively as directed by Owner.
- I. Acceptable Products: Standard Lockers; Penco Products, Inc.
  - 1. Type J: Six Tier, 15"W x 24"D x 12" Tall - with continuous flat tops, recessed handle, and staple with provisions for Owner-furnished padlocks.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls, floors, and support bases and verify that bases are properly sized and located. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
- B. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36" o.c. The use of sheet metal screws for assembly and installation is not allowed.
- C. Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

### 3.3 ADJUST AND CLEAN

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint.
- C. Touch-up marred finishes or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 10 56 13

METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal storage shelving.

1.2 SUBMITTALS

- A. General: Submit following items in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Include complete manufacturer's catalog cuts and data sheets, complete parts list, installation requirements, and all pertinent performance characteristics and criteria.
- C. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, and installation details.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Provide metal storage shelving of the same manufacturer throughout the project.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide metal storage shelving as manufactured by one of the following:
  - Lyon Workspace Products
  - Penco Products, Inc.
  - Republic Storage Systems Co.
  - Richards-Wilcox
  - Tennsco
  - Western Pacific Storage Systems

2.2 MATERIALS

- A. Basis of Design: Provide RiveTier Long Span Shelving as manufactured by Western Pacific Storage Systems (1-800-270-0427).
  - 1. Sizes: As shown by Drawings, and with a shelf capacity of 1000 lbs.
  - 2. Metal Shelves: 22 gauge steel; seven (7) shelves per unit unless otherwise shown or noted.
  - 3. Standard Duty Angle Upright Post - LURH - 14 gauge steel.
  - 4. Provide two (2) pair side sway braces per unit.
  - 5. Provide one (1) pair back sway braces per unit.

2.3 FABRICATION

- A. Fabricate metal storage shelving square and rigid with posts plumb and true, and shelves flat and free of dents or distortion. Fabricate exposed metal edges free of sharp edges and burrs. Fabricate connections to form a rigid structure, free of buckling and warping.
- B. Finish: Manufacturer's standard factory-applied paint, color as selected by Architect.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install metal storage shelving in strict accordance with manufacturer's written instructions and recommendations.
- B. Install metal storage shelving level, plumb, square, and true.
- C. Install bracing as recommended by manufacturer and as required for stability.
- D. Single line installation against walls shall be braced to walls using threaded anchors (block walls) or bolted to wall/in wall blocking (drywall wall). HAMMER DRIVE ANCHORS ARE NOT PERMITTED.

### 3.2 PROTECTION

- A. Protect the completed work from damage. Replace damaged items which cannot be repaired. Protect finished installation in accordance with SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

### 3.3 CLEANING

- A. Upon completion of the building, clean the metal storage shelving. Leave the metal storage shelving free of defects and in ready-to-use condition.
- B. Perform final cleaning in accordance with SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 10 73 26

PREFABRICATED WALKWAY COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Prefabricated walkway canopies and wall-mounted suspended canopies.
- B. Related Requirements:
  - 1. Section 03 30 00 - Cast-in-place Concrete.
  - 2. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Include drawings showing small scale layouts of prefabricated walkway canopies and large-scale details of edge conditions, joints, expansion joints, anchorages, trim, closures, and special details.
- C. Samples: Submit two 12" square samples of finished metal panels.
- D. Certification: Submit design calculations sealed and signed by an engineer registered in the State of Texas. Design calculations shall state that the protective cover system design complies with the wind requirements of all governing jurisdictions, the stability criteria of applicable building code, and all other governing criteria.

1.3 QUALITY ASSURANCE

- A. Wind Loading: Fabricate and install prefabricated walkway canopies and other components of system to comply with code requirements for resisting wind effects based on a 110 mph wind.
- B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the canopy manufacturer and has completed installation of canopies similar in material, design, and extent to canopy required for this project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide prefabricated walkway canopies as manufactured by one of the following:
  - AVAdek
  - Dittmer Architectural Aluminum
  - Mapes Industries, Inc.

2.2 MATERIALS

- A. Aluminum Sheets: Extruded aluminum sections, Alloy 6063, T6 temper.
- B. Structural Supports: Extruded aluminum sections, Alloy 6063, T6 temper.
- C. Fasteners: Manufacturer's standard non-corrosive types, with heads gasketed.
- D. Accessories: Provide components required for a complete prefabricated walkway canopy system, including fascia, trim, closures panels matching deck profile at all open canopy flutes over structure and other canopy components, clips, fillers, and similar items. Match materials and finishes of prefabricated walkway canopy framing.
- E. Finish and color selection of each component shall be chosen from the manufacturer's color selections and shall include:
  - 1. Clear anodized finish (minimum thickness of 0.7 mils).

2. Hardcoat bronze anodized finish (minimum thickness of 0.7 mils).
3. Prefinished fluoropolymer coating containing 70% Kynar 500. Color shall be custom or standard color as selected by Architect from Fluropon colors as manufactured by Valspar.
4. Polyester Baked Enamel. Color as selected by Architect.

## 2.3 FABRICATION

- A. General: Fabricate and finish canopies and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and dimensional requirements. Internal gutters shall connect to weep system.
- B. Wall-mounted Suspended Canopies:
  1. Hanger Rods: Round aluminum rods with baked enamel finish.
  2. Gutter shall scupper out at each end.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine surfaces to receive prefabricated walkway canopies for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. General: Comply with canopy fabricator's and material manufacturer's instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor supports and other components of the work securely in place, with provisions for thermal and structural movement. Install expansion joints to provide for thermal and structural movement.

### 3.3 CLEANING AND PROTECTION

- A. Damaged Units: Replace canopies and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.
- B. Cleaning: Upon completion of canopy installation, clean finished surfaces as recommended by canopy manufacturer, and maintain in a clean condition during construction.

END OF SECTION

SECTION 10 82 13

EXTERIOR GRILLES AND SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Steel screen fencing **at Dumpster**.

B. Related Sections:

1. Section 03 33 00 - Cast-in-place concrete.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 33 23. Include installation instructions for fence posts, fabric, gates, and accessories.

B. Erection and detail shop drawings will be provided showing layout and location of all component parts. Panel sizes, clips, gates, gate hardware, attachment details, base requirements and panel installation bolts will be enumerated on the drawings. Installation bolts will be supplied by the installer (not by manufacturer). Drawings will need to be approved by customer prior to fabrication.

1.3 QUALITY ASSURANCE

A. Provide fences as complete units controlled by a single source, including necessary erection accessories, fittings and fastenings.

1.4 WARRANTY

A. The polyester-coated hot-dip galvanized metal is guaranteed not to crack, peel or blister for a period of 7 years.

PART 2 - PRODUCTS

2.1 PRODUCT/MANUFACTURER

A. Basis of Design: Provide Shadow 80 horizontal design, 80% direct visual screening, metal fencing with double swing gates, as manufactured by Ametco Manufacturing Corp. (ph. 800-321-7042) or approved equivalent.

2.2 MATERIALS

A. Electro-forge welded steel fencing that is hot-dip galvanized (ASTM 123) and then powder polyester coated.

B. 80% view-blocking louver. 3/32" thickness formed sheet metal louvers (may be positioned horizontally, vertically or inverted in horizontal position to effectively block sight lines from below). Louvers positioned and held in place by 5/32" round crossbars forming a 1-13/16" x 5-7/32" mesh. Custom engineered panel system banding/framing/mounting clips per fabrication detail.

C. The steel bars have a yield strength of 36,000 psi and a tensile strength of 58,000 psi. Post yield and tensile strengths are similar to steel bars.

D. Gates:

1. Gate frames are fabricated from steel tubes.
2. Swing gates are furnished with posts, hinges, padlockable slide bolt, and padlockable cane bolt.

E. Finish: Powder coat finish: Color as selected by Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation and erection before final grading is completed.
- B. Installation of fence shall be by skilled fence erector and on lines and grades indicated.

### 3.2 INSTALLATION

- A. Fence Posts:
  - 1. Fence posts shall be of sufficient length to allow for setting into concrete footers.
  - 2. The standard fence post spacing 78 $\frac{3}{4}$ " apart; however, special spacings shall be used when required.
  - 3. In-ground posts shall be set in concrete in holes 12" diameter for terminal posts and 10" in diameter for intermediate posts.
  - 4. Concrete should be 6" deeper than the posts. Deeper and wider settings may be necessary in some locations.
  - 5. After fence is plumb and level, pour concrete grouting into holes.
- B. Swing Gates:
  - 1. It is important that gate posts have substantial footings and be installed plumb.
  - 2. Level concrete shall be cured before hanging gates.
  - 3. Most gates will be bolted with slotted holes to the post--adjust shim to level gate as required.

END OF SECTION

SECTION 11 40 00

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK

- A. Project Name and Location: Cy Creek High School Renovations  
9815 Grant Rd, Houston, TX 77070
- B. Approval of Working Surface: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. The beginning of work by any contractor shall constitute acceptance of the previous work.
- C. Field Verification of All Dimensions: Before ordering any materials or doing any work, field verify all measurements of the building and be responsible for their accuracy. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect or Foodservice Design Professionals (FDP) for instructions before proceeding.
- D. Cutting and Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true, and of the proper size in their work, as may be necessary for the proper installation of their and other contractors' work. After such work has been installed, the contractor shall carefully fit around, close, repair, patch, and point up the same as directed to the satisfaction of the Architect.
- E. Cooperation: The General Contractor, all other contractors, and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity to install their work and store their material.
- F. Inspection and Tests: The architect, Owner, Foodservice Design Professionals (FDP), and their representative shall always have access to the work, whether in preparation or progress. Provide proper and safe facilities for such access and inspection.
- G. Fees, Permits, and Inspections: Secure and pay fees for all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, codes, rules, regulations, and contract requirements bearing on the work.

1.3 SCOPE OF WORK

- A. Include the Work specified, shown, or inferable as part of Food Service Equipment. Portions of this Work may be subcontracted to those qualified to do such work as necessary because of jurisdictional trade agreements and restrictions.
- B. The General Contractor is responsible for Related Work specified in other Sections: i.e., final plumbing, electrical and mechanical connections. The Kitchen Equipment Contractor (KEC) is responsible for all internal connections.
- C. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and equipment adjustment in this contract. Plans and specifications shall be considered mutually explanatory. Work required by one, but not by the other, shall be performed as though required by both.



Items required by one but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings so that all equipment items shall be entirely functional for the purpose for which they were designed and intended. Provide all necessary material, tools, equipment, and labor required for the complete delivery, un-crating, erection, and installation as designated on the food service equipment plan and, in the specifications, to be made ready for final connection by the appropriate Division contractors. When there is any discrepancy between drawings and specifications, bidders should seek clarification of any discrepancies from the Architect and or Foodservice Design Professionals (FDP) before bidding.

- D. Should the drawings disagree in themselves or the specifications with the drawings (*and clarification was not sought before bidding*), the higher cost, better quality, more stringent, and greater quantity of the work or materials shall be completed without additional costs to the Owner.

#### 1.4 OTHER DIVISIONS/CONTRACTORS RELATED WORK

- A. Division 03 (Concrete) is responsible for but not limited to:

1. Slab depressions reinforced concrete wearing bed at prefabricated walk-in assemblies.
2. Concrete or masonry platforms (with a finished top and coved base at the perimeter) for the raised setting of food service equipment.
3. Slab depressions to receive stainless steel drain trench liner/grate assemblies (provided under this Section).

- B. Division 09 (Finishes) responsible for but not limited to:

1. Interior finished floor with a coved base at prefabricated walk-in assemblies.

- C. Division 10 (Specialties) responsible for but not limited to:

1. S/S Corner Guards throughout the kitchen (unless specified otherwise).
2. Lockers.

- D. Division 22 (Plumbing) is responsible for but not limited to:

1. All connections shall be made in accordance with local codes and national standards, except where plans and specifications exceed those codes and standards.
2. Empty PVC and wide-sweep bends for refrigerant piping to beverage lines, Co2 lines, and remote food service equipment refrigeration systems.
3. Rough-in and final connection of plumbing systems to food service equipment and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 22. This includes but is not limited to the installation of all faucets (water fill faucets, pre-rinse faucets, etc.), hoses, gas disconnects, and drains from the equipment point of connection to building plumbing systems. All drain lines are provided and installed by Div. 22.
  - a. Kitchen Equipment Contractor is responsible for providing all faucets (water fill faucets, pre-rinse faucets, etc.), drain fittings, mixing valves, control valves, water pressure regulators, vacuum breakers, and all accessories for equipment specified under 11 40 00. Division 22 is responsible for installation.
4. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type 'K' Copper.
5. If any plumbing accessories or fittings are provided loose with equipment by 11 40 00, Div. 22 is to attach to equipment and provide final connection.

6. Gas Supply Systems with all components and fittings required for a complete system.
7. Water Supply Systems with all components and fittings required for a complete system.
8. Compressed Air Systems with all components and fittings required for a complete system (if required for this project).
9. Piping and Drainage Systems (Sanitary and Grease-laden). ***Systems must be cleaned and flushed before the final connection with food service equipment - Critical.***
10. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.
11. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.
12. Trench Drains (Provide and Install). Trench Liners provided by 11 40 00. Flange and liners to be flush with the finished floor.
13. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe through Grease Trap and/or Interceptor.
14. P-Traps as required (including all disposers).
15. Interconnect water through Water Filter (Filter provided by 11 40 00 unless otherwise specified) to equipment.
16. Gas Quick Disconnect Installation (Quick Disconnect provided by 11 40 00).
17. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 11 40 00).
18. Specified couplings and piping to all equipment furnished by 11 40 00.
19. Air Compressors (if required for this project) (Size, Provide, and Install unless otherwise specified).
20. Water Softeners (if required for this project) (Size, Provide, and Install unless otherwise specified).
21. Pressure Boilers (if required for this project) (Size, Provide, and Install unless otherwise specified).
22. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required. Water temperature to be at least 100 degrees and flow for at least 20 seconds.
23. Ice Bin Drain Insulation (if Ice Machine is provided in this project) (Provide and Install).
24. Unions at disposer solenoid valves (if Disposer is provided in this project) (Provide and Install).
25. Back Flow Prevention as required (Provide and Install - including all disposers). Back- Siphonage shall be installed at all fixtures and equipment where backflow and/or back-siphonage may occur and where a minimum air gap cannot be provided between the water to the fixture or equipment at its flood/level rim. When furnished with equipment, vacuum breakers shall override the above if acceptable with applicable codes. Division 22 is responsible for verifying requirements with local codes.
26. Janitor Sink with Faucet (Provide and Install).
27. Freeze Proof Hydrant at the exterior of the building by receiving door (Provide and Install - unless otherwise specified).
28. Reverse Osmosis Systems (Size, Provide (unless otherwise specified), Locate, and Install).

29. All piping within the counter body or under fabricated counters must be run to a connection point below the counter body by Section 11 40 00—final connection by Division 22.
  30. Exhaust Hood condensate drain connections (if Exhaust Hood is provided in this project) (Provide and Install).
  31. Interconnection of ½" CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker (if Disposer is provided in this project).
  32. Fire System Piping. The exposed piping is to be chrome plated.
  33. Pipe ½" cold water to swirl inlets at disposers (if Disposer is provided in this project).
  34. Water Treatment for Ice Builders (Non-Chlorinated water with a PH Level of 10 or Higher) and any drains and overflows. Piping from Ice Builders to Tumble Chillers by Div. 23 (if Ice Builders and Tumble Chillers are provided in this project).
  35. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.
- E. Division 23 (Mechanical) responsible for but not limited to:
1. All connections shall be made following local codes and national standards, except where plans and specifications exceed those codes and standards.
  2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.
  3. Rough-in and final connection of mechanical systems to food service equipment, walk-in assemblies, and between components (including materials and labor).
  4. A mechanical contractor will test and balance rooms and exhaust hoods. **Balance report for food service Exhaust Hoods to be provided to Foodservice Design Professionals (FDP) immediately upon completion (send to Houston.Submittal@fdp.org) and must be submitted with O&M manuals.**
  5. Exhaust Hoods, Condensate Hoods, Fire Suppression Systems, connections, and controls (Provide and Install – unless otherwise specified). Provide tempered air at all supply ducts.
    - a. If Exhaust/Condensate Hoods and Fire Suppression Systems are specified under Section 11 40 00, Division 23 is responsible for all Exhaust and Condensate Hood connections (Provide and Install).
  6. VFD System and controllers when required by code (Provide and Install).
  7. Provide and install all ventilation (direct or indirect), air conditioning, and heating systems (unless otherwise specified).
  8. Coordinate Supply and Return ducts above Serving Counters. No cold air is to blow directly on hot food counters or open-air refrigerated merchandisers.
  9. Coordinate Supply and Return ducts away from equipment with top-mounted refrigeration. No cold air is to blow directly on compressors.
  10. Mechanical Contractor to locate temperature monitors within return ducts.
  11. Circulating air above walk-in assemblies (Provide and Install).
  12. Circulating air above and in air gaps at warehouse cold storage assemblies (Provide and Install).
  13. Water Chillers as required (if equipment is provided in this project) (Provide, Size, and Locate).

14. Piping from Ice Builders to Tumble Chillers (if equipment is provided in this project) (Size, Provide and Install).
15. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

F. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, walk-in assemblies, and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 26.
2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.
3. Empty EMT Conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPUs, etc. Division 26 to verify where the conduit will run for POS System (i.e., Manager's Office or IDF Room).
4. Empty EMT Conduit with pull-wire and wide-sweep bends for fire suppression systems. Interconnect the Fire Protection System to panel box shunt trips and building alarms.
5. Walk-in Assembly Light Fixture Installation (Provided loose by Section 11 40 00) (if Walk-in is provided in this project).
6. Table Limit Switch Installation (Provided loose by Section 11 40 00) (if Dishmachine is provided in this project).
7. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).
8. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).
9. Charging Stations for Forklifts, Pallet Stackers, and Pallet Jacks (Size, Provide, Locate, and Install) (if equipment is provided in this project).
10. Interconnection between Condensate Fan and Dishmachine control panel (if equipment is provided in this project).
11. Interconnection between Exhaust Hood fans and switch (if equipment is provided in this project).
12. Interconnection between Exhaust Hood lights and switch (if equipment is provided in this project).
13. Door Heaters, Lights, Coils, and Heated Pressure Relief Ports pre-wired to the junction box at the top of walk-in assemblies (if equipment is provided in this project) provided by Section 11 40 00— final connection by Div. 26.
14. If any electrical accessories, fittings, and cord/plugs are provided loose with equipment by 11 40 00, Div. 26 is to attach to equipment and provide final connection.
15. Provide waterproof receptacles in wet areas.
16. All electrical connections beneath Exhaust Hoods (if equipment is provided in this project) to extend to shunt trip breakers with electrical panel box for shutdown during fire mode.
17. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.
18. All electrical lighting, power, and distribution systems.
19. Do not interconnect more than three (3) convenience outlets on one (1) breaker.

20. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.
  21. Doorbell at receiving door (Provide and Install –audible throughout Kitchen, Office, and Dry Storage room).
  22. Adequate lighting at receiving door.
  23. Dedicated circuit for heated drain line connection in Walk-In Freezer (120/1/16.0 Amp) at each coil.
  24. (if Walk-in is provided in this project) Provide and install (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. One (1) to be located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an 'inline' assembly), and One (1) to be located in the Cafetorium (Coordinate location with Owners). Provide all conduit and wiring required and interconnect the illuminated Push Button Panic Alarm in the Walk-In Freezer to both Strobe Beacons (**Critical**). Coordinate with Division 27.
  25. Electrical contractor to provide conduit with pulled wires prior to installation of equipment.
  26. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.
- G. Division 27 (Communication) responsible for but not limited to:
1. Data line coordination for food service equipment.
  2. Time clocks as required.
  3. Video cameras for learning assistance in food service areas as required (Provide, Locate, and Install).
  4. (if Walk-in is provided in this project) (Provide conduit, data line, and interconnect the illuminated Push Button Panic Alarm inside the Walk-In Freezer to the Building Automation System (BAS). When activated, facility personnel are to be notified - coordinate notification requirements with the Owner (**Critical**). Coordinate with Division 26.
- H. Division 28 (Electronic Safety and Security) is responsible for but not limited to:
1. Security Cameras as required (Provide, Locate, and Install).
- I. General Contractor responsible for but not limited to:
1. Any wall penetration required for food service equipment utilities. Escutcheon plates or S/S sleeves are to be provided and installed as needed.
  2. Bulk Freezer Ventilation Pipe (if Bulk Freezer is provided in this project) (Provide and Install unless otherwise specified).
  3. Core drilling for Guide Rails (if Guide Rails are provided in this project).
  4. Refrigeration Roof Curbs / Roof Jack (if Refrigeration System is provided in this project and located on the roof).
  5. Interior Bollards (if required for this project) – to be epoxy painted per local codes (Provide and Install).
  6. Furnish and Install ¾" Plywood blocking in the wall for mounting equipment furnished by Section 11 40 00 as required.
  7. Walk-in Depressions (to be dead level) and sand leveling bed (if Walk-in is provided in this project and recess is shown).

8. Structural bracing for Bulk Walk-in Assembly ceiling panels if required.
9. Menu System Video Monitors in Servery (unless otherwise specified).
10. Structural bracing for Menu System Video Monitors if required.
11. Interior/Exterior refrigeration penetrations and sleeves at building penetrations.
12. DoorScope viewer (peephole) with wide viewing angle at receiving door.
13. Canopy at receiving door. Coordinate height with the height of Receiving Door (8') and the mounting height of Air Screen above the door.
14. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.
15. Washer and Dryer (Provide and Install, unless otherwise specified).
16. Dwarf wall at exposed front/ends of cafeteria serving counters with the finish as selected by the Architect if required in this project).
17. Final cleaning of all equipment before demonstrations.

#### 1.5 QUALITY ASSURANCE

- A. In addition to complying with all applicable laws, statutes, building codes, and regulations of public authorities, comply with the following:
  1. National Sanitation Foundation (all equipment to bear label)
  2. National Electric Code
  3. Underwriters' Laboratories, Inc. (all applicable equipment to bear label)
  4. American Gas Association Laboratories
  5. National Fire Protection Association
  6. Americans with Disabilities Act
  7. Food and Drug Administration HACCP Guidelines
  8. International Energy Conservation Code (IECC)
  9. Department of Energy
  10. Environmental Protection Agency
  11. CSA Group
- B. Furnish certification of regularly manufactured equipment listing or classification by Underwriter's Laboratories, Inc. with the initial submittal.
- C. Furnish a list of equipment and components (internal and external) that are not of domestic origin. All equipment and components (internal and external) should be of domestic origin when possible. This information should be provided with the initial submittal.
- D. Projects outside the continental United States shall adhere to all local authorities having jurisdiction over that project.

## 1.6 SUBSTITUTIONS

- A. **The specified equipment items or components are intended to be the basis of the bid. All other brands, including any additional names, which may be listed as “Alternates” or “Approved Equal,” must conform with the general and item specifications, warranties, size/dimensions, quality, accessories, function, voltage, horsepower, etc. of the first-named brand and be subject to Paragraph C-03 of this Article.**
- B. Proposed Substitutions:
1. Submitted at least 14 calendar days before Bid Date.
  2. Submit proposed substitutions with catalog data and manufacturer’s shop details indicating all modifications required to conform with the specified brand.
  3. List of deviations must include equipment name, model number, accessories, and features with deviation(s) noted for specified and proposed alternate equipment. Equipment without listed deviation(s) will be considered furnished as specified.
- C. Substitutions with prior approval:
1. Submitted on Bidder’s letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.
  2. Owner reserves the right to accept or reject any or all substitution proposals before execution of the Contract.
  3. Provide all design/engineering services required to adjust in space, systems, utilities, etc., and pay all additional costs of utilities, construction, or professional services that may be incurred due to the acceptance of any substitution.
- D. All appliances or other equipment within a common group or category (e.g., refrigerators, kettles, ovens, shelving, etc.) must be from the same manufacturer.

## 1.7 INTERPRETATION OF DOCUMENTS

- A. During Bidding: Bidder’s, supplier’s, or vendor’s questions and comments about Construction Document’s clarity or intent will be addressed by addendum.
- B. After Award:
1. Clarification Bulletin will confirm Construction Document requirements.
  2. Request for Information submitted by Contractor shall contain Contractor’s proposed resolution.

## 1.8 WARRANTY

- A. Provide a written warranty for parts and labor for one year **from the date of Substantial Completion**, including an extended four-year replacement warranty on compressor bodies.
- B. Components of equipment subject to replacement before one year’s use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.
- C. Refrigeration Systems/Equipment: One-year free service available within twenty-four hours of notification.

- D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number, and name of the person to contact. The service agencies selected shall be factory-authorized for the equipment assigned whenever possible.
- E. Provide the following for refrigeration systems/equipment unless specified otherwise:
  - 1. One (1) year of free refrigeration system service is available within twenty-four hours of notification.
  - 2. Provide five (5) year manufacturer's registered written replacement warranty certificate covering compressor bodies. Warranty to cover labor costs for the first year.
  - 3. Provide ten (10) years of the manufacturer's registered written replacement/repair warranty certificate covering walk-in assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.
  - 4. Provide two (2) year parts and labor warranty for **all parts/components (including third-party components that may be utilized)** of the refrigeration system(s) **(including freon)**, walk-in cooler(s), and freezer(s) not otherwise covered herein.
- F. **All above-stated warranty periods are from the date of Substantial Completion.** All replacement parts due to a warranty call should be the same quality as the original, or better if the original were defective. Replacement parts should be of a domestic origin where possible.

1.9 SUBMITTAL DATA

- A. **All submittals must be received, reviewed, and approved as noted prior to equipment procurement. If any equipment is procured prior to this process, it is on the KEC to replace any equipment, accessories, or other components that may not meet the specifications or design intent for the facility, including all costs associated with rectifying the errors made procuring the equipment before this critical process.**
- B. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.
- C. Submittal Requirements:
  - 1. Kitchen Equipment Contractor to furnish all submittals via PDF, drawings to be scaled per General Specifications and provided in Three (3) submittal packages.
  - 2. Foodservice Design Professionals requires the below-listed business days for each package submitted. Packages are to be submitted within 14 days between each issued package. Each package should contain individual submittal sets.
    - a. Package One to include (2) Individual sets: 10 Business Days for Review
      - i. Equipment rough-in
      - ii. Equipment Brochure
    - b. Package Two to include (3) Individual sets: 10 Business Days for Review
      - i. Exhaust Hoods
      - ii. Walk-in Cold Storage Assemblies
      - iii. Refrigeration
    - c. Package Three to include (4) Individual sets: 15 Business Days for Review



- i. Custom Fabrication
  - ii. Serving Counters
  - iii. Merchandising Equipment
  - iv. Miscellaneous Submittals
- D. Submittals to be identified with the below-listed file name structure:
  - 1. 11 40 00-1 EQUIPMENT BROCHURE
  - 2. 11 40 00-2 EQUIPMENT ROUGH-IN PLANS
  - 3. 11 40 00-3 CUSTOM FABRICATION
  - 4. 11 40 00-4 SERVING COUNTER
  - 5. 11 40 00-5 EXHAUST HOODS
  - 6. 11 40 00-6 WALK-IN COLD STORAGE ASSEMBLY
  - 7. 11 40 00-7 REFRIGERATION
  - 8. 11 40 00-8 BEVERAGE MERCHANDISER
- E. Package One (1) requires both submittals: Brochure and Rough-in plans. **If not sent together, the submittal will be rejected.**
- F. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.
- G. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.
- H. If discrepancies, missing information, or incorrect information occur within the documents, Kitchen Equipment Contractor is to seek clarification or note the need for further direction on submittals. The Kitchen Equipment Contractor is to bid the higher of the discrepancies. *Refer to Section 1.3 SCOPE OF WORK: Subsection D.*
- I. Brochure Format (for regularly manufactured equipment and components):
  - 1. Front and rear protective cover with labeled project name.
  - 2. Brochure index: Indicate Functional Area/Room number, item number, quantity, description, and manufacturer.
  - 3. A separate flysheet for each component or item of equipment, indicating item number, name, quantity, manufacturer, optional equipment, modifications, special instructions, and utility requirements. Any equipment or assembly containing more than one buyout sub-assembly or component shall have the second item listed in parenthesis beside the primary item name—for example, Serving Counter (hot food well).
  - 4. Catalog specification sheet with all options notated on the specification sheet and manufacturer's drawing.
- J. Shop Drawings (Rough-In Drawings):
  - 1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced). Submittal drawings are to be provided by Kitchen Equipment Contractor

and not copied or reproduced from Contract Documents. Any reproduced submittal drawings will be rejected.

2. 1/4" scale drawing of fixed/movable food service equipment and prefabricated Walk-in assemblies with itemized schedules.
3. Special Conditions Drawings, sizing, and locating the following conditions:
  - a. Slab depressions, cores, sleeves, or block-outs (walk-in assemblies, drain trenches, piping, etc.).
  - b. Concrete or masonry platforms.
  - c. Pipe sleeves or roof jacks.
  - d. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.
  - e. Blocking grounds or anchor plates required in walls for equipment support/attachment.
  - f. Above-ceiling hanger assemblies for support of exhaust hoods, ceiling-mounted pot racks, etc.
  - g. Access panels in walls or ceiling for service of equipment.
  - h. Ceiling pockets or recesses for unusually high equipment.
  - i. In-wall carriers for wall-hung or cantilevered equipment.
4. Electrical Rough-In Drawing
5. Plumbing and Mechanical Rough-In Drawing
6. Required information:
  - a. All fixed and portable food service equipment shown on Contract Drawings.
  - b. All prefabricated Walk-In Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.
  - c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices, not in this Section.
  - d. All Rough-In Drawings: Fully dimensioned from engineering benchmark (column lines, when provided) and finished-room surface to the point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical, and plumbing services.
  - e. Connection number/tag system and symbols: Identical to Contract Drawings.
- K. Shop Drawings (Manufacturer's and Fabricator's):
  1. Sheet Size: Identical to Contract Drawings, drawn or plotted at a 1/4" scale for plan view, 1/2" for elevations, and 1 1/2" for sections and construction details.
  2. Included information: The item number, name, and quantity.
  3. Construction details, sections, and elevations to reflect the requirements of the Specifications and Drawings.
  4. Indicate adjacent walls, columns, and equipment.

5. Indicate plumbing and electrical schematic drawings for equipment such as conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems, and fabricated fixtures with a single electrical or plumbing connection.
6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment, or replacement of all moving parts.
- L. All equipment and engineering rough-in plans sheet numbers are to match the contract documents. All equipment item numbers and engineer item numbers located on the schedules are to match the contract documents. All engineering requirements must be updated to accommodate the provided equipment and match the contract documents. The Kitchen Contractor coordinates any MEP revisions to accommodate the supplied and proposed equipment. The Kitchen Equipment Contractor is responsible for any costs associated with equipment substitution.
- M. Foodservice Design Professionals (FDP) drawings and schedules are not to be copied in any way. Any replicated drawings of Foodservice Design Professionals (FDP) will be rejected.

#### 1.10 SERVICE MANUAL

- A. Three copies bound in 1½" hardback, three-ring binders (as many volumes as required by the scope of the project) with the same data as the brochure after installation (Refer to "Submittal Data"). Provide separate service manuals for each independent area within the project scope (Main Kitchen, Culinary, Concession, etc.).
- B. Each Volume: Section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).
- C. Catalog specification sheet and/or manufacturer's shop drawings.
- D. Each Volume: Index of items, manufacturer's operating/maintenance information, replacement parts data, list of all product warranties, and price lists. Provide the name, title, and address of personnel at each respective manufacturer and service personnel to be contacted for spare/replacement parts and service after the warranty period.
- E. To the greatest extent possible, provide two copies of the manufacturer's instructional video cassettes for operating, maintenance, and equipment service.
- F. Internally subdivide binder contents with permanent page dividers, logically organized by equipment item number or manufacturer name, with tab titling printed under reinforced, laminated plastic tabs.
- G. Electronically submitted manuals must follow the formatting requirements listed above.
- H. **Service Manual to be provided to the owner before kitchen equipment demonstration.**

#### 1.11 VERIFICATION AND COORDINATION OF PROJECT / DATA

- A. Utilities Rough-in Drawings and field verifications are to be completed within four weeks after receipt of notice-to-proceed. Review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors.
  1. KEC to provide on-site field verification of all underground utilities before pouring concrete for capacity and location and coordinate with General Contractor. Submit a review to Architect and General Contractor. If rough-ins need to be relocated, KEC will compensate other trades for the required relocation.
  2. KEC to provide on-site field verification of all other utility connections and locations and coordinate with General Contractor. Submit a review to Architect and General Contractor.
- B. On-Site Inspection Reports

1. Before concrete pour: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.
2. Before delivery of equipment: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.



FOODSERVICE DESIGN PROFESSIONALS

## On - Site Inspection Report Prior to Concrete Pour

Inspection Date \_\_\_\_\_ Project Name \_\_\_\_\_

Project Location \_\_\_\_\_

Inspector's Name \_\_\_\_\_ Company \_\_\_\_\_

Inspector's Contact Number \_\_\_\_\_ Email \_\_\_\_\_

Architectural Firm \_\_\_\_\_ Project Architect \_\_\_\_\_

Architect's Contact Number \_\_\_\_\_ Email \_\_\_\_\_

General Contractor \_\_\_\_\_ Project Manager \_\_\_\_\_

G.C. Contact Number \_\_\_\_\_ Email \_\_\_\_\_

Food Service Consultant Foodservice Design Professionals, LLC Project Manager \_\_\_\_\_

Contact Number 281.350.2323 Email \_\_\_\_\_

An on-site Inspection to verify the location of UNDERGROUND utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials \_\_\_\_\_

**This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.**

**Neither the Architect nor FDP need to be present at these inspections.**

**EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE  
ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN  
PROFESSIONALS, LLC.**



## On - Site Inspection Report

Prior to Delivery of Equipment

Inspection Date \_\_\_\_\_ Project Name \_\_\_\_\_

Project Location \_\_\_\_\_

Inspector's Name \_\_\_\_\_ Company \_\_\_\_\_

Inspector's Contact Number \_\_\_\_\_ Email \_\_\_\_\_

Architectural Firm \_\_\_\_\_ Project Architect \_\_\_\_\_

Architect's Contact Number \_\_\_\_\_ Email \_\_\_\_\_

General Contractor \_\_\_\_\_ Project Manager \_\_\_\_\_

G.C. Contact Number \_\_\_\_\_ Email \_\_\_\_\_

Food Service Consultant Foodservice Design Professionals, LLC Project Manager \_\_\_\_\_

Contact Number 281.350.2323 Email \_\_\_\_\_

An on-site inspection to verify the location of INSTALLED utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials \_\_\_\_\_

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.  
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE  
ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN  
PROFESSIONALS, LLC.

- C. Review critical systems/components for application, performance, and capacity and submit calculation worksheets with the initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:
1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes, and locations.
  2. Refrigeration Systems (compressor, condenser, and evaporator) capacities/sizes, quantities, and refrigerant piping distances/sizes.
  3. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler, fuel interlocks, piping/distance limitations).
  4. Locations of Vacuum Breakers.
  5. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.
  6. Gas and water line sizes and manifold configurations.
  7. Diameter and length of flexible connector lines for fixed/movable gas appliances.
  8. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).
  9. ADA compliance of workstations, service positions, passageways, etc.
- D. Ceiling mounted appliances/fixtures: Verify and coordinate dimensions/location of support framing/hangers with the General Contractor—all material and installation below 12'-0" AFF: Section 11 40 00.
- E. Dimension Responsibility: Obtain actual or guaranteed measurements for the proper equipment fit. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment and notify the Architect of all conflicts or deviations from the dimensions shown.
- F. Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for their correctness. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.
- G. Scheduling to Fit Openings: Should it become necessary to schedule the construction of walls or partitions before delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.
- H. Refrigerated and Dry Storage Areas: Verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of the variance between the Contract Documents and actual conditions.
- I. Color/Pattern Selections: Submit selection samples of solid polymer products, plastic laminate, paint or stain finishes, and vinyl-coated surface material of equipment as selected by the Owner.
- J. Movable Equipment Interface: Rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at the time initial of shop drawing submittal. Indicate conflicts and proposed adjustments.

- K. Relocation of Work: Relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.
- L. **Kitchen Equipment Contractor must provide FDP with the food service equipment lump sum pricing (including material and labor) after the contract has been executed and before submittals are provided to FDP. This information is critical to FDP for accounting/billing purposes.**

#### 1.12 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

- A. Obtain and coordinate utility requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and rough-in drawings/provisions.
- B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

#### 1.13 WORK INSTALLED BUT FURNISHED BY OTHERS

- A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with the Owner at least ninety (90) days before equipment requirement.
- B. Obtain and coordinate utility requirements of OF/CI equipment with the building utilities and rough-in drawings/provisions.
- C. Receive at the job site and fully incorporate into installation procedures as if furnished under this Section.

### PART 2 - PRODUCTS

#### 2.1 FABRICATED FIXTURES MATERIAL / COMPONENTS

- A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.
  - 1. Stainless steel joints and seams: Heli-arc welded, free of pits and flaws, ground smooth, and polished to a No. 4 finish.
  - 2. The "grain" direction of horizontal stainless-steel surfaces: Longitudinal, including the backsplash. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.
- B. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.
  - 1. Galvanized iron joints and seams: Arc-welded, free of pits, flaws, and ground smooth.
  - 2. Galvanized sheets or shapes: Washed with mineral spirits and painted with Rust-Oleum gray semi-gloss enamel.
- C. Sound Deadening: Schnee Butyl Sealant ½" wide rope positioned continuously between all frame members or contact material and underside of stainless-steel surface (sinks, tabletops, food wells, over shelves, and undershelves). Tighten stud bolts for maximum compression of sealant and trim excess.
- D. Plastic Laminates: Color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be NSF-approved (Standard No. 35).
- E. Solid Polymer products: Color/pattern/material selected by Architect in thickness as specified. Solid Polymers and adhesives must be N.S.F. approved (Standard No. 51).
- F. Casters:



1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Verti-Lock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.
- G. Cutting Boards: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated.
- H. Identification Plates, Labels, Tags:
  1. Prohibited Information: Names of suppliers, fabricators, and contractors.
  2. NSF Labels: Required on all pieces of equipment.
  3. Required Information: Function or purpose of controls such as display light switches, food warmer controls, etc.
  4. Plate Construction: Engraved phenolic plastic, secured to equipment with epoxy cement or stainless-steel screws. Furnish samples.

## 2.2 PLUMBING / MECHANICAL REQUIREMENTS

- A. Plumbing Fittings and Components: Furnished under this Section as follows:

Note: Fitting and components described in Items 1, 2, 3, 4, and 5 are furnished loose by 11 40 00 for final installation and connection by Division 22.

1. Control valves and appliance pressure regulators for water, gas, steam, and vacuum breakers: wherever required on food service equipment (chrome-plated where exposed).
2. Faucets and drains with and without connected overflows (unless otherwise indicated) for all sinks.
3. Specialty food service water-fill faucets, hose bibbs, or hose assemblies indicated in drawings/specifications.
4. Wade Model No. W-10 Shock-Stop shock absorbers for all food service equipment with quick-opening or solenoid-operated water valves.
5. Dormont Series Water Quick Disconnect hose, diameter per water connection size requirements, with safety fitting, w/coiled restraining device, full port ball valve, antimicrobial coating, lifetime warranty.
6. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food-holding components of serving counters (e.g., cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: All drains to be type 'K' Copper – Paint with aluminum paint where exposed. **Div. 22 to ensure a minimum air gap of 1" and not less than twice the effective opening of the indirect waste pipe, per code. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.**
7. Piping brackets and supports beneath fabricated equipment.
8. Closed Base Bodies: Removable 18-gauge stainless steel closure panel at plumbing penetrations under the top.
9. Control valves on Open Base fixtures: Mounted on a 14-gauge stainless steel gusset-shaped panel with h 3½" setback from the countertop edge/rim to the face of the control handle.

10. Fill hose/faucet at support pedestals or Closed Base Body: Installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger-bracket for the hose.
11. Provide filtration option as shown on contract documents (a, b, c, or combination thereof):
  - a. In-line Water Filter System:
    - i. Everpure System filters for coffee/tea brewers, icemakers, water chillers, convection steamers, and beverage systems. They should be sized per the manufacturer's recommendation.
  - b. Remote Central Water Filter System.
  - c. Remote and/or In-line Reverse Osmosis system.
- B. Gas-Heated Equipment Fittings and Components: Furnished under this Section as follows:
  1. Fixed Equipment: Dormont 1675KIT2S48 gas appliance connector: Diameter per fuel volume/connection size requirements. Gas valve diameter size per fuel volume/connection size requirements.
    - a. Restraining device: Heavy duty steel cable, fastened to equipment and walls, 3" to 6" shorter than equipment connector length.
- C. Final Plumbing Connections Provisions:
  1. Fabricated equipment containing components, fittings, and devices indicated on food service connection drawings to be connected to the building systems: each component, fitting, or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.
  2. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.
  3. All plumbing final connection points of equipment shall be tagged, indicating the following:
    - a. Item number
    - b. Name of devices or components
    - c. Type of utility (water, gas, steam, drain, chilled water)
- D. Ducts and Vents:
  1. Exhaust hoods furred-in to ceiling: 2" high duct collar for final connection to the duct system.
  2. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18-gauge stainless steel seamless duct risers to 6" above the finished ceiling for final connection. The duct: trimmed at the ceiling with a 16-gauge stainless steel angle flange with all corners welded.
- E. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Sub Sections E. Plumbing and F. Mechanical for additional information.

## 2.3 FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS

- A. Install complete with all refrigerants, oil, dials, dehydrators, gauges, and controls required for the system's proper operation.
- B. Self-contained or factory-installed compressors: Check and adjust to the proper operating temperature prescribed by FDA/HACCP.

## 2.4 PLUMBING TRIM

- A. Faucets: Furnished for all sinks or equipment requiring open water supply.
- B. Fill Faucets: Furnished for appliances requiring open water supply.
- C. Drain Fittings: Furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. The solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

## 2.5 ELECTRICAL REQUIREMENTS

- A. All electrical systems, components, and accessories within the work of this Section: Certified to be in accordance with NEC 70.
- B. Electrical Fittings and Components: Furnished under this Section as follows. Coordinate food service equipment loads, voltage, and phase with the building system and confirm any existing or OF/OI equipment requirements.
- C. Cord and Caps:
  - 1. Coordinate all food service equipment cord/caps with related receptacles.
  - 2. All 120, 120/208, and 208 volts "plug-in" equipment shall have Type SO or SJO cord and plug with ground wire fastened to the frame/body of the item.
  - 3. Cord lengths for fixed equipment: Adjusted to eliminate loose-hanging excess.
  - 4. All non-fixed plug-in "buy-out" equipment: Hubbell configuration and ratings as required.
  - 5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8'-0" cord length with cord-hanger strap secured to the rear of equipment or mobile stand.
- D. Switches and Controls:
  - 1. Each motor-driven appliance or electrically heated unit: Equipped with a control switch or starter per Underwriters' Laboratories, Inc., with low-voltage and overload protection.
  - 2. Disposer controls recess-mounted in the wall: External fittings and accessories removed from the enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 4'-0" AFF to the bottom of the enclosure.
  - 3. Disposer controls recess-mounted in counter-splash risers: External fittings and accessories removed from NEMA 4 enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 3'-0" AFF to the bottom of the enclosure. Provide the panel with a 60" long Seal-Tite electrical conduit from the bottom of the control panel for final field connections under Division 26.
  - 4. Equipment that is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.

5. All remote manual starters, disconnect switches, magnetic contactors or starters, and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.
- E. Heating Elements:
1. Electrically heated equipment: Thermostatic controls.
  2. Water heating equipment: Equipped with positive low water shut-off.
- F. Receptacles and Switches:
1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12" x 8½" x 3" deep recessed mounting panel sloped at a 60° angle and turned up to the top of the opening.
  2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6" from the bottom of utility or compressor compartments.
  3. Receptacles mounted on Open Base fixtures: Installed on a 12" x 10½" x 4½" deep 14-gauge stainless steel panel with returned ends and sloping recess—secure panel to the underframe of fixture top.
  4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on the underside of the lower shelf. Vertical runs of wiring: Made in rigid conduit or within the tubular leg.
  5. Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.
  6. Switches installed in/on-fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and a junction box installed within 6" from the bottom of the utility or compressor compartment. All refrigeration system switches: Installed within the compressor compartment near the door opening.
  7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to the load center with balanced phase loading. Load center: Ready for final connection by Division 26 and flush-mounted within the utility compartment rear panel, set back 8" from the access door. All breaker/device information will be typewritten on the circuit schedule in the load center door (number corresponding breaker/device) with an enclosed schematic wiring diagram of fixture components.
  8. All receptacles are to be pre-wired to the cord and plug assembly and routed through the over-shelf post at all island equipment locations unless specified otherwise.
- G. Light Fixtures:
1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).
  2. LED Display Light: Install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.
  3. Heat Lamps: Installed to the underside of serving shelf assemblies. When multiple 24" heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remotely from lamps.
  4. **Walk-in assembly LED Light Fixtures: Furnished by Section 11 40 00, final installation by Div. 26. All electrical wiring and conduit, provided by Div. 26, electrically connected**

**through the Vapor Proof light fixture base connection, located on the interior door header—all Conduit to be EMT Watertight. Door frame wiring stubs out the top of panels 8" in flexible conduit for final connection by the electrical contractor. All horizontal conduits: below ceiling panels. All lighting fixtures will be wired from inside the assembly—no penetrations through the ceiling panels. Seal-sleeved penetrations are airtight at both sides of the panel. KEC is responsible for verifying that trade contractors seal all penetrations.**

H. Final Electrical Connection Provisions:

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: Direct connected, with each component, fitting, or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.
2. Fabricated equipment containing electrically operated components and devices indicated: Circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.
3. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawings by Division 26.
4. Pre-wire the following groups of walk-in assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).
  - a. Light fixtures and switches; heated pressure-relief ports.
  - b. Door/jamb heaters.
  - c. Evaporator fans, defrost elements and drain line heaters.
5. All electrical final connection points of equipment shall be tagged, indicating the following:
  - a. Item number.
  - b. Name of devices on the circuit.
  - c. Total electrical load.
  - d. Voltage and phase.
- I. Lamps: in all food service equipment containing light fixtures. Refrigerator or heated cabinets: All exposed LED lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.
- J. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection F. Division 26 (Electrical) for additional information.

2.6 CUSTOM – FABRICATED / ASSEMBLED UNITS

- A. Mechanical or electrical operating components or products integrated into a fabricated fixture: Ventilation and service access required or recommended by the manufacturer. The size and placement of the service access panel(s) permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 BAKER TABLETOPS (Unless specified otherwise)

- A. 14-gauge 304 S/S top with 2" square turn down at the front, 6" high enclosed splash at two (2) sides and rear. Brace same as "Counter/Tabletops."
- B. 1¼" x 6" high integral coved riser at rear and ends unless indicated otherwise on drawings.
- C. 16-gauge stainless steel flour-trough at free long sides, secured to the underside of the top. Trough: 3" diameter with eased edges/corners.

2.8 COUNTER / TABLETOPS

- A. 14-gauge stainless steel; all free edges turned down 2" with ¾" tight hem at the bottom—free corners: rounded on ¾" radius.
- B. Marine edges: Turned up ½" on 45° angle and turned down 2" with ¾" tight hem at the bottom.
- C. Cafeteria serving countertops at hot food stations: Full-length x 3½" x ½" high raised rail at (customer's) front side with 45° integral turndown to counter surface.
- D. Tops abutting high fixtures or walls: Cove up specified height and slope back 1½" at the top on 45° angle; 2½" slope where piping occurs. Turn down 1" at the rear of the splash and tight ends to the bottom of the top turndown. Secure splash turndown to the wall with a 4" long 14-gauge stainless steel "Z" clip anchored to the wall, 36" OC.
- E. Freestanding tables and all serving counter splash-risers: Turned back at a 90° angle with 1" turndown at the rear.
- F. Brace tops with rigid-welded 1½" x 1½" x 1/8" galvanized steel angle frame at the perimeter with cross bracing 2'-0" OC maximum. Provide 4" x 4" x 12-gauge stainless steel triangular pads where leg gusset welds to frame. Paint the entire frame with Rust-Oleum gray semi-gloss enamel. Angle frames: Secured to the underside of top surfaces with ¼" studs welded 9" OC maximum with chrome-plated washer, lock washer, and cap nut. Studs: Such length that cap nuts can be made up tight, bringing the top down snugly on the angle frame, eliminating all vibrations or "oil-canning."
- G. Tops: 1½" overhang at free sides of underframe or Closed Base Body.
- H. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly or integrally welded stainless-steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground, and polished to match the top. When conditions permit, provide a 1" x 1½" rectangular backsplash opening for service utilities instead of piercing the horizontal surface. Install stainless steel split tubing at the raw edge of the opening.
- I. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.
- J. All openings in tops: 3/16" high raised die-formed edges.
- K. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½" deep, secured to the underside of the countertop.
- L. All "built-in" and "drop-in" counter equipment/appliances to have framing members at the perimeter of the opening.
- M. Scrap Basket: 18-gauge stainless steel construction 6½" x 6½" x 21¾" long. Top of container: 5/8" wide x ¼" high full perimeter flange with ¼" diameter stainless steel rod bail handle. Interior vertical corners coved on ½" radius. Countertop: Fitted with 6¾" square die-stamped opening.

## 2.9 COLD PANS

- A. 14-gauge stainless steel with  $\frac{3}{4}$ " coved interior welded integrally to the countertop with a  $\frac{3}{16}$ " raised edge at the perimeter of the opening – depth of cold pan to follow NSF 7 compliance.
- B. Slope bottom to required quantity of Component Hardware Model No. E16-4021 drain fittings at 48" OC maximum. Sleeve through insulation at drain fittings and extend common drain line into utility compartment for indirect waste connection.
- C.  $\frac{1}{2}$ " OD copper refrigerant lines in a serpentine pattern,  $1\frac{1}{2}$ " OC flattened for maximum contact. Secure tubing to the underside of  $\frac{1}{4}$ " thick aluminum "distribution plate" installed tight to the underside of the frost plate area and apply cold-conductive mastic to all surfaces.
- D. Component Hardware Model No. E16-4021 drain fittings at 48" OC maximum, sleeved through the insulation with common drain line extended into utility compartment.
- E. Heat Cable: Low-wattage, full-perimeter, below countertop at the edge of depression. Secure with "Z" clips, 9" OC, and interwire with compressor switch for simultaneous operation.
- F. Enclose the sides and bottom of pans with an airtight 18-gauge galvanized jacket and pack with 2" fiberglass insulation set in mastic.
- G. Compressor: Size as indicated or required to accommodate the size of the cold pan. Locate the compressor in the compartment below the unit or as shown on the drawings.
- H. Sectional 16-gauge stainless steel perforated false bottom ( $\frac{1}{4}$ " holes, @  $\frac{3}{4}$ " OC). Turn down  $1\frac{1}{2}$ " on all sides, weld corners, and provide finger rings. False bottom sections: 24" long maximum.

## 2.10 DRAWERS

- A. Stainless Steel Liners: Component Hardware Model No. S81-2020C (20" x 20"), easily removable with drawer in the fully extended position.
- B. Drawer Frame: 16-gauge stainless steel flanged out at the top. Weld the frame to a double-panel 16-gauge stainless steel drawer front with full-length recessed pull at the top (similar profile as Garco Model No. R-1060) with closed ends.
- C. Channel-formed horizontal pull:  $\frac{3}{4}$ " turndown at the front and ends with  $\frac{1}{2}$ " tight hem. The front edge of the pull: flush with the face of the drawer. Recess behind pull: sloped up on a 60° angle, terminating 1" below the bottom edge of pull.
- D. Mount drawer frame on Component Hardware Model No. S52-2020 self-closing slides, with Delrin bearings, full-depth of the fixture. Secure slides to the body or brackets to eliminate lateral movement in the extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides with Delrin bearings.
- E. Drawer enclosure in an Open Base Fixture: 18-gauge stainless steel flanged out at the top for attachment to the underside of the tabletop. The lower edge of the enclosure is flanged in toward the open bottom. Mount drawer slides to enclosure and brace as required. The face of the enclosure is to be the same length and height of the drawer face. Provide  $\frac{3}{4}$ " deep offset in front of the enclosure and  $2\frac{1}{2}$ " from the underside of the tabletop for a flush-fitting appearance.
- F. Drawer enclosure on freestanding fixture: Full depth of table framing.
- G. Drawer enclosure in a Closed Base Fixture: Completely partitioned from the adjoining area. Drawer front: Flush fitting with the face of the body.

- H. Drawer Liners other than tool/utility: **Bread Drawer:** S/S liner sized to fit drawer; **Refrigerated Drawer:** S/S liner sized to fit drawer.
- I. Cash Drawer: Integral stainless-steel body, 3" deep.

## 2.11 FOOD WELLS (UNLESS SPECIFIED OTHERWISE)

- A. Food Warmer Controls: Remote-mounted in sloping recessed apron panel. The control panel is recessed 2½" from the bodyline at the top of the 60° slope and 1" at the lower edge. Terminate slope angle 2½" below the countertop. Mount panel on concealed piano hinge at bottom edge; secure with screws at upper corners.
- B. Manifold all warmer drains and extend to within the utility compartment for indirect waste connection. Install valve in the drain line and extend handle through compartment door.
- C. Removable 18-gauge stainless steel closure panel at the underside of warmers.
- D. 14-gauge stainless steel plate/utensil shelf full-length of hot food station unless noted otherwise: 10" below countertop x 9" deep, with rear panel coved up to the underside of the countertop; end panels turned up square. Front of shelf: Turned down 1½" and returned under for closure panel attachment.
- E. Food wells: Hatco Model No. HWBIBRT-FULD insulated food warmer (1200 watts, 208 volts, single phase) secured to the underside of 12" x 20" die-stamped countertop openings with thermal breaker mastic rope applied at the perimeter of food well flange.
- F. Soup Warmers: Hatco Model No. HWB-11QTD soup warmer secured to the underside of 11" diameter die stamped countertop opening with thermal breaker mastic rope applied at the perimeter of soup well flange. The maximum allowable temperature of the countertop at the contact surface is: 120°F. Each warmer: Equipped with one 11-quart stainless steel round insert and slotted cover.

## 2.12 SINKS

- A. 14-gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.
- B. Continuous exterior panels of multiple-compartment sinks: 14-gauge stainless steel filler panel welded ground and polished between compartments.
- C. Sinks (with overflow): Score and slope sink bottom ½" to die-stamped opening fitted with Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. 14-gauge stainless steel bracket: Welded to sink bottom for drain stem with 1½" handle clearance.
- D. Where sinks are installed in fixtures with Closed Base Body, provide a Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. (Sinks with dimensions larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14-gauge stainless steel bracket: welded to sink bottom with T & S Model No. BL-4740-1 guide bushing. Install on shortened drain stem, one T & S Model No. BL-4710-1 remote control stem assembly only (length as required) with Model No. 113-L universal joint and white blank button. Set drain control handle in Cambro Model PSB-6 bowl with bottom omitted (dress raw edge) to permit passage of drain handle—secure bowl in utility compartment door or body panel with clear silicone.
- E. When single-hole deck-mounted faucets are specified, install overflow fitting in the sidewall of the sink compartment and provide ell-fitting in connecting tubing.
- F. Flush Covers when specified: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated. Support clips: ¼" stainless steel rod 2" long, formed at 45° with two ¾" leg ends (¼" long threaded ends). Insert rod clips through tight-clearance holes in the sink, seal watertight, and secure with stainless



steel acorn nuts or tack-weld at the exterior of the sink wall. Set support clips  $\frac{1}{2}$ " below the top. Provide a 14-gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: Adjacent to sink compartment, below countertop, or under drawer assembly.

#### 2.13 TRAY SLIDES (UNLESS OTHERWISE SPECIFIED)

- A. Tray slides: 12" wide, solid 14-gauge stainless steel turned up 2" at the rear behind countertop turndown; turned down 4" at the front and free ends unless otherwise indicated.
- B. Three  $\frac{1}{4}$ " high die-formed inverted "V" ridges at 4" OC, 2" from the leading edge, terminating 2" from ends of tray slide with tapered ridge ends.
- C. Ridges formed on radius: Equal-length segments with 2" separation between chords.
- D. Secure tray slides to countertop/body frame, same as "Countertops." Enclose the exposed underside of the tray slide with 18-gauge stainless steel.
- E. When indicated, project tray slides 2" beyond the serving countertop and return the entire width of the serving counter at free ends.
- F. All tray slides are to be provided and mounted per ADA requirements.

#### 2.14 DISHTABLES

- A. Soiled/clean dishtable: 14-gauge stainless steel; free edges coved up 3" with  $1\frac{1}{2}$ " diameter rolled rim and bullnose corners.
- B. Edge of dishtables next to high fixtures or walls: Coved up 10" and sloped back  $1\frac{1}{2}$ " on 45° angle;  $2\frac{1}{2}$ " slope where piping occurs. Turn down 1" at the rear of splash and secure to wall with 4" long 14-gauge stainless steel "Z" clips anchored to the wall, @ 36" OC.
- C. Exposed rear splash: 16-gauge stainless steel finish panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end. Secure the panel with concealed attachment and install bracing 24" OC.
- D. Cove all interior corners (horizontal/vertical) on  $\frac{3}{4}$ " radius and slope tables  $\frac{1}{8}$ " per foot to sinks, scuppers, or ware wash machines, maintaining level crown/splash.
- E. Brace dishtables with 1" x 4" 12-gauge stainless steel channels down the top centerline and between each pair of legs, with closed ends. Bracing: secured to the underside of the dishtable with  $\frac{1}{4}$ " studs welded 6" OC maximum, with chrome-plated washer, lock washer, and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."
- F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops; ground and polished to match the top.
- G. Hose Bibb: Chicago Model No. 305VBRCE; mounted on 12-gauge stainless steel flange or inverted gusset bracket with  $\frac{3}{8}$ " stainless steel rod hose hanger.
- H. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.
- I. Paper-Drop Opening: 9" square with 4" integral chute having hemmed bottom edge. Slope dishtable top 1" toward the opening, forming a 16" square tapered deposit point.

- J. Accessible Tray-Drop Opening: 10" x 18" with integral 16-gauge stainless steel seamless chute sloped at 45° angle toward the center of mobile soak sink position.
- K. All dishtables with a Conveyor Type Dishmachine must have a table limit switch provided by Manufacturer and installed by Division 26. Wiring must be concealed within dishtable fabrication.

## 2.15 DISH / TRAY DEPOSIT ASSEMBLY

- A. 14-gauge stainless steel deposit shelf, size as indicated. Extend the frame through the opening, flush with the public side of the partition, height as local code authorities require. Turn the shelf down 1" at the front with ¾" return at the bottom (either scribed into a partition or forming reveal). Shelf: 1" square turndown at the long rear side, integral with conveyor slider pan, tray-accumulator, or dishtable. Extend the rear/end splash to align with the head of the deposit station opening. Modify rolled rim at the operator's side of the tray drop window to have a 3" rolled rim.
- B. 18-gauge stainless steel window frame with perimeter flange channel-formed 1" x ¾" at both wall sides. Weld all corners of the frame and install with concealed attachment. Align/about one jamb of the frame with end splash of conveyor slider pan or dishtable whenever adjacent.

## 2.16 UTENSIL – WASH COUNTERS

- A. 14-gauge stainless steel; all free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.
- B. Edges of utensil-wash counters next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45° angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and secure backsplash to the wall with 4" long 14-gauge stainless steel "Z" clip anchored to wall @ 36" OC. Vacuum breaker pockets: 4" long square turnback sections aligned with the slope break line.
- C. Exposed Rear Splash: 16-gauge stainless steel finished panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end of the splash and ½" turnback at the bottom of the panel. Secure the panel with concealed attachment and install bracing 24" OC.
- D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot, maintaining level crown.
- E. Brace utensil-wash counters with 1" x 4" 12-gauge stainless steel channels down the centerline of the top and between each pair of legs, with closed ends. Bracing: Secured to underside of dishtable with ¼" studs welded 6" OC. maximum, with a chrome-plated washer, lock washer, and cap nut. Studs: Such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."
- F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match the top.
- G. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on a leg/bracket assembly.
- H. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

## 2.17 DOORS

- A. 18-gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal the perimeter joint of the pans. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the Body.

- B. Channel-formed full-length horizontal recessed pull:  $\frac{3}{4}$ " turndown at the front and ends with  $\frac{1}{2}$ " tight hem. The front edge of the pull: Flush with the face of the door. Recess behind pull: Sloped up on a  $60^\circ$  angle and terminated 1" below the bottom edge of pull.
- C. Door Hardware
  - 1. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).
  - 2. Component Hardware Model No. 35-2000 Concealed Magnetic Catch.
  - 3. Component Hardware Model No. D30-4780 lock in the upper free corner of the door.
- D. Louvered opening: Cut-out opening size as indicated, turn in 1", and weld. All corners: Ground and polished.
  - 1. Full-height 18-gauge stainless steel louver with 1" vanes at  $45^\circ$ ,  $\frac{1}{2}$ " spacing. Perimeter channel-formed frame:  $1\frac{1}{2}$ " x 1".
  - 2.  $45^\circ$  x 1" x  $\frac{1}{2}$ " x opening width plus  $\frac{1}{2}$ " 18-gauge stainless steel louver.
  - 3. Tack the louver flange's weld tab to the door's back panel.
- E. Drain handles opening: 6" diameter hole through the double pan to accommodate Cambro Model No. PSB-6 Bowl:
  - 1. Secure the bowl to the door panel with clear silicone.
  - 2. Omit the bottom of the bowl. Dress raw edges of opening for passage of drain handle.
  - 3. Exposed insulation at the penetration of the door pan: Painted black.
- F. Sliding Doors: fabricate same as Paragraph "A."
  - 1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required. Secure to angle frame at the top of the underside.
  - 2. Front/rear door sheaves: Stainless steel  $\frac{3}{4}$ " side-mounted door hangers; two (2) required per door.
  - 3. Recessed Vertical Pull at Upper Corner of Door: Component Hardware Model No. P63-1012.
  - 4. By-Passing Door Guides secured to bottom shelf: Component Hardware Model No. B62-1093.
  - 5. Door Stop at the bottom edge of door: Component Hardware Model No. B60-1086.
- G. Offset the lower horizontal framing member of the Closed Base Body/utility compressor compartment to align the door flush with the bottom of the Body.

## 2.18 CLOSED BASE BODIES

- A. Frame: Rigid-welded  $1\frac{1}{2}$ " x  $1\frac{1}{2}$ " x  $\frac{1}{8}$ " galvanized steel angle forming a continuous structure around the top and bottom perimeters of the fixture, a post at each corner, studs spaced 48" OC maximum. The top of the frame is cross-braced with  $1\frac{1}{2}$ " angles, 2'-0" OC maximum.
- B. 18-gauge stainless steel panels and trim with concealed attachment. All seams: Welded, ground, and polished.

- C. Exposed Vertical Corners: Rounded on  $\frac{3}{4}$ " radius. Closed Base Bodies adjacent to walls or fixtures: square corners.
- D. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: Closed and sealed.
- E. Closed Base Bodies set on finished masonry platforms: closed and caulked at the underside of equipment overhang and bolted to the platform. Body overhang of the platform: 1" at free ends and 2" at the front and exposed rear sides.
- F. Closed Base Bodies not set on the platform: Component Hardware Model No. A54-2-6, 6" legs spaced 4'-0" OC maximum.

## 2.19 COMPRESSOR COMPARTMENTS

- A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.
- B. 10-gauge steel slide-out support: Channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on the solid platform: front-to-back slide-out support channels set 4" above the bottom for air circulation.
- C. Access Door: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full length of the top (similar profile as Garco Model No. R-1060) with closed ends. Channel-formed horizontal pull:  $\frac{3}{4}$ " turndown at front and face of the door. Recess behind pull slopes up on a 60° angle, terminating 1" below the bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.
- D. Access Doors Louver: Full-height, with  $1\frac{1}{2}$ " x 1" x 18-gauge stainless steel channel-formed frame with welded corners. 18-gauge stainless steel louver. Submit a sample of the design for approval.

## 2.20 UTILITY COMPARTMENTS

- A. Closed Base Bodies or Pedestal Supports: Fitted with utility compartments wherever piping or wiring is required in/on the fixture.
- B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.
- C. Access Doors: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full-length of the top (similar profile to Garco Model No. R-1060) with closed ends. Channel-formed horizontal pull:  $\frac{3}{4}$ " turn down at the front of the door, a recess behind the pull slopes up on a 60° angle, terminating 1" below the bottom edge of the pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of the door with the face and bottom edge of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.
- D. No shelves of Closed Base Fixtures are to be penetrated.

## 2.21 UTENSIL RACKS

- A. Rack:  $\frac{1}{4}$ " x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match the shape shown on drawings. Lowest band - 7'-6" AFF unless otherwise indicated.

- B. Ceiling Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing from band to 18" above the ceiling. Anti-sway bracing above the ceiling - 1½" Unistrut members. Tubing penetrations at the ceiling - Component Hardware Model No. A16-0206 stainless steel gussets.
- C. Table Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing extended through countertop. Secure to closed base framing or cross rail/undershelf on the open base fixture. Tubing penetrations of countertops - integrally welded stainless steel inverted gusset.
- D. Utensil Rack Hooks - Component Hardware Model No. J77-4401 stainless steel hooks spaced 8" OC maximum.
- E. Electrical Receptacle: NEMA No. 5-20-R or as noted. Mount in fully welded 3½" x 5½" x 3" 14-gauge stainless steel enclosure with ½" radius corners. Stainless steel cover plate to fit specified receptacle. Pre-wire through tubular support for final connection above the ceiling by Division 26.

## 2.22 CASHIER / SERVING COUNTERS

- A. Exterior Body Panels, when specified: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.
- B. Position, size, and finish horizontal or vertical reveal as Architect directs.
- C. Secure panels to counter body framing in a concealed manner. Install removable panels with "Z" clips overlapping body framing members.
- D. Hinged doors in exterior body panel(s) - Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three (3) required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with the submittal.
- E. Cashier counter to have 16-gauge s/s intermediate shelf, turned down 1 1/2" with tight hem at front. Cove up 2" at rear and sides. Brace undershelf with 1" x 4" 14-gauge stainless steel channel at the longitudinal centerline. Provide an outlet for power/data within the body above the intermediate shelf. Provide cash drawer inserts per district standards.
- F. Sneeze Guards to be adjustable and meet NSF standards.

## 2.23 OPEN BASE STRUCTURES

- A. 1-5/8" OD x 16-gauge seamless stainless-steel tubing legs beveled at the bottom. 1¼" OD cross rails fully welded (360° smooth and polished) to legs at 10" AFF, OC.
- B. Top of Leg: Inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.
- C. Bullet Foot: Component Hardware Model No. A10-0851.
- D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to the floor with non-corrosive bolts.
- E. Table Bases: Maximum leg spacing of 6'-0" OC; dishtable and utensil wash counter bases at 5'-0" OC.
- F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): Tubular legs at the front side only with Component Hardware Model No. A10-0854 flanged feet anchored to the floor with non-corrosive bolts. Front-to-back cross rail: fitted into Component Hardware Model No. A20-0406 circular gusset secured to the wall with non-corrosive bolts.

## 2.24 UNDER SHELVES

- A. Open Base Structures: 16-gauge stainless steel turned down 1½" with tight hem at the bottom. Notch all corners to fit tubular legs and weld from the underside to fill the gap, grind, and polish. Cove up 2" at the rear or ends adjacent to wall, columns, refrigerators, etc. The turn-up at freestanding fixtures is to be hemmed tight to the bottom of the turndown. Brace undershelf with 1" x 4" 14-gauge stainless steel channel at the longitudinal centerline and each intermediate pair of legs.
- B. Open Base Structure specified to be supported by brackets at the rear side only (not completely cantilevered): 16-gauge stainless steel turned down 1 ½" at free sides with tight hem at the bottom edge. Notch all corners to fit tubular legs as required and weld from the underside to fill the gap, grind, and polish. Cove up 2" at rear ends, as indicated. Fill the gap at the front-to-back rail, grind, and polish. Brace undershelf with 1" x 4" x 1" 14-gauge stainless steel channel at longitudinal centerline between front to back rails.
- C. Closed Base Fixtures: 16-gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: Turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.
  - 1. Shelves: Turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.
  - 2. All shelf partitions at exposed ends of cabinet bodies or interiors: Free of exposed framing members.
  - 3. Reinforce shelves with full-length 1" x 4" x 14-gauge stainless steel closed hat channel.
  - 4. Unless otherwise noted, all closed base undershelves must be 22" deep and clear.
  - 5. Fully weld smooth and polish the vertical seam of the shelf turndown/turn up with the face of the body partition.
  - 6. Seal the vertical seam of the square turn-in at the exposed interior of open shelf sections.

## 2.25 ANCHOR PLATES / WOOD GROUNDS

- A. Behind the finished surface, wherever building walls, partitions, or ceiling construction will not accommodate direct attachment of equipment such as over shelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 11 40 00.
- B. Anchor Plates: Not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.
- C. Wood Grounds: Length required by fixture, component, or device, 24" wide x ¾" thick plywood secured to partition system before gypsum board installation.
- D. Above ceiling supports: Structural shapes (4" x 8.0 lb. channel) suspended from the structure. Maximum height 15'-0" AFF. Size: width of equipment x length of equipment plus 6'-0". Cross bracing at 6'-0" OC maximum.

## 2.26 OVER SHELVES

- A. 16-gauge stainless steel with free edges turned down 1" with ½" tight hem at the bottom—¾" radius at free corners.
- B. Turn up 2" raw at walls and sides with a horizontal coved corner at the rear. Round front corners of turn up on ¾" radius.

- C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14-gauge stainless steel closed hat channel full-length of the shelf.
- D. Wall-Mounted Shelves: 16-gauge stainless steel brackets 48" OC maximum, set in 6" from ends.
- E. Freestanding Shelves: Where splash is required at free over shelves, turn up square 2" at ends, cove up at the rear, and hem tight to lower edge of front turndown. Weld exposed corners.
  - 1. Freestanding over shelves: 16-gauge stainless steel cantilevered brackets at the rear of the table; double-cantilevered brackets at the center of the table. Posts for cantilevered over shelves are 1-5/8" OD x 16-gauge stainless steel secured to the underframe, 4'-0" OC. Ends of shelves: Secured to adjacent wall/fixture or mounted on 1¼" diameter stainless steel posts.
  - 2. Freestanding over shelves not on cantilevered brackets: 1¼" OD x 16-gauge stainless steel posts, each pair at 4'-0" OC maximum.
- F. Baker Table Over shelves: Supported 18" above the top with 1¼" OD stainless steel tubular supports with channel shoe secured to risers.
- G. Glass/Cup Rack Over shelf at Dishtables: 14-gauge stainless steel with 1½" deep "vee" trough at free long sides with 1" tight hem inside the trough. Provide a ½" marine edge at free ends and; a 4" splash at the wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" OD stainless steel tubing supports from the structure above the ceiling at front edge, 60" OC at each end.
  - 1. Install at both ends a ½" stainless steel drain tube (connecting both vee-troughs) extended to the dishtable surface through splash turnback.
  - 2. Rack-rest: horizontal full-length 1-5/8" OD stainless steel tubing supported at 10" OC above shelf (8" OC for double service shelf) by 1¼" OD stainless steel tubing with closed ends. Support tubing: welded, ground, and polished, spaced 60" OC.
  - 3. Rack-rest supports to wall: 4" x 4" x 10-gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

## 2.27 DRAIN TRENCH LINER / GRATING

- A. Liners: 14-gauge stainless steel in sizes as indicated.
- B. Interior of liners: 6" deep with all interior corners (horizontal/vertical) coved on ¾" radius; sloped and scored 1" to integrally welded Component Hardware Model No. D34-Y011 basket drain assemblies @ 48" OC, fitted with 6" long welded tailpiece. Stainless steel safety chain: connected to basket strainer assembly and top of liner wall.
- C. Liners: 1" wide perimeter shoulder at the top, turned up flush with finished floor, tight hemmed back down to the shoulder level, and flanged out 2" for attachment to the slab.
- D. Underside of sloping liner portion: 2" long "Z" clips.
- E. Grating: IMC-TEDDY PFD-ADA removable fiberglass grating:
  - 1. 1" deep "I" bearing bars with 0.6" wide top flange.
  - 2. Full perimeter frame, section quantities, and sizes indicated.
  - 3. Maximum of 2'-0" sections.
  - 4. Grating bars should be spaced 0.4" apart per ADA requirements.

5. Grating to be two (2) equal sizes.

## 2.28 WALL PANELS

- A. Wall Panels: 18-gauge stainless steel, double pan-formed  $\frac{1}{2}$ " thick with internal stiffener members. Fill with USDA-approved thermal insulation, full height, and width of panels, and attach to the interior with mastic. The maximum allowable temperature at the rear side of the panel: is 120°F.
  1. Height of panels as required: Top of tile base to the underside of the hood, top of tile base to the top cap of stub wall, or top of splash to the underside of the hood.
  2. Level and square lower edge and sides.
  3. Butt joints on all panels.

## 2.29 EXHAUST HOODS (SURFACE-MOUNTED CONDENSATE)

- A. Hoods: Size/shape as indicated: 18" high on the interior.
- B. Body: 16-gauge stainless steel, with all seams welded, ground, and polished.
- C. Continuous condensate trough at perimeter: 3" x 1".
- D. Frame the top of the hood with  $1\frac{1}{2}$ " angle iron assembly and suspend from the structure above the ceiling by  $\frac{1}{2}$ " diameter steel rods, drawn tight against the finished ceiling surface.
- E. Duct opening/collar as specified with stainless steel louvered grille over the opening.
- F. Div. 22 to extend drain line to floor sink when shown. The drain line is to be silver painted. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.
- G.  $\frac{1}{2}$ " diameter steel hanger rods at 4'-0" OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
- H. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.

## 2.30 EXHAUST HOODS (UNLESS SPECIFIED OTHERWISE)

- A. Exhaust to be provided to meet all current local jurisdiction mechanical and energy code requirements. Kitchen Equipment Contractor to verify code requirements and coordinate with Divisions 23 and 26. Hoods over production equipment to be Type 1 with continuous capture. All Type 1 hoods should be 6' deep to ensure smoke/steam capture unless otherwise noted.
- B. Install fire suppression system(s) in all ventilators specified in this section. Install per the manufacturer's recommendations and applicable codes or standards. Submit installation certification form to Architect.
- C. Locate chemical cylinders as indicated on drawings and install piping to exhaust hood(s) in a concealed manner. Set cylinders and cabinets at 7'-0" clear AFF unless noted otherwise. Provide polished chrome plated tubing piping/fittings, where exposed at cylinder location and at the interior of exhaust ventilator—exposed pipe threads in/above the food zone are not allowed. Submit a schematic installation diagram and confirm critical distances from cylinders to nozzles.
- D. Remote manual release located in the path of egress from the protected exhaust hood area. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements before submittal review. All conduits will be recessed within the wall; SURFACE MOUNTING WILL NOT BE ACCEPTED.



- E. Provide one (1) handheld Type 'K' and ABC 6-liter fire extinguisher per Ansul system, surface wall mounted.
- F. Required quantity and sizes of mechanically operated gas valves.
- G. Confirm interconnection of all equipment as required to ensure exhaust hood and fire suppression systems are entirely operational and meet local jurisdiction code requirements.
- H. ½" diameter steel hanger rods at 4'-0" OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
- I. Provide an appropriate quantity of fire suppression systems as required by local jurisdiction code requirements.
- J. Double wall insulated construction at ends. S/S where exposed.
- K. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.
- L. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection E. Division 23 (Mechanical) for additional information.

#### 2.31 HIGHLIGHTING

- A. Polish the following vertical surfaces to a No. 8 finish:
  - 1. Serving and display shelf turndowns.
  - 2. Conveyor and dish/tray deposit station turndowns/frame.
  - 3. Tray slide turndowns.

#### 2.32 SHOP / FIELD JOINTS

- A. Field joints: The least number is used only when equipment size must be limited for building or interior space access.
- B. Stainless steel tops (including edges and splashes): Fully welded, ground, and polished to match adjacent surfaces.
- C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of the field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw joints: located and noted on shop drawings.
- D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to the back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide a flat backing surface for a joint with the angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" OC.
- E. Closed Base Bodies: Draw-type with hairline seam fully field-welded.
- F. Millwork: Plastic laminated joints shall be dowelled, glued, and draw-bolted with fasteners.
- G. Solid Polymer: Surfaces drawn tight, filled, sanded, and finished to match adjacent surfaces.

## 2.33 PREFABRICATED WALK-IN COLD STORAGE ASSEMBLIES

- A. Assembly to be installed by Factory Authorized Installers only.
- B. KEC to provide a 1-year walk-in assembly panel installation warranty. Panel installation warranty to cover labor and part replacement issues resulting from a failure to complete the following during installation:
  - 1. Walk-in assembly panels to be installed square, plumb, and level.
  - 2. To create a proper seal, ceiling panels must be installed flush and tight to wall panels with undamaged gasket material. Any signs of condensation at joints or assembly wall panels should be reported to FDP and addressed immediately. Caulk at panel seams will not be an acceptable solution.
  - 3. All cam-locks should be engaged and cam-lock covers in place.
  - 4. Any gaps under the floor angle (due to shimming) must be entirely sealed to the slab.
  - 5. All penetrations in the ceiling or wall panels should be insulated and sealed by appropriate trade contractors and verified by KEC, including but not limited to Light Fixtures, Refrigeration Lines, Sprinklers, Temperature Sensors, etc.
  - 6. Proper installation of the door systems should allow the door to self-close and seal around the perimeter of the door opening and at the floor threshold.
  - 7. Final operation of the IC/IC+ control, door heaters, and light switches should be confirmed upon completion of the electrical connections.
  - 8. The walk-in assembly panel installation warranty will cover service issues resulting from faulty installation.
- C. **KEC is responsible for overall install accuracy/quality and quality control of work performed regardless of installer or any field modifications due to building/construction conditions. KEC is to provide a Letter of Install Approval to Foodservice Design Professionals (FDP) upon completed installation, verifying that all items above have been inspected by the KEC for completeness and installed per manufacturer requirements. This letter will be required as part of the completion of the contract.**
- D. Sectional Assemblies: Size/shape indicated on drawings; 9'-6" interior clearance unless otherwise specified. Door locations/size: exactly as shown.
- E. Sandwich Panel Insulation: Class 1 Urethane with a vapor barrier, 4" thickness (unless specified otherwise) with mature "U" factor of .030 or lower. Finished panels shall be UL-listed and demonstrate a flame spread rating of 20 or less. Panels must meet performance standards as outlined in U.S. Government legislation.
- F. Wherever compartment dimension exceeds the clear-span ability of ceiling panels, provide I-beam support on the exterior of the ceiling or spline-hangers. Install ½" diameter steel rods through beams/hangers and secure them to the structure above. Beams or posts within compartments are not acceptable.
- G. Reinforce prefabricated wall panels to rigidly support the door assemblies. The perimeter of the door and frame shall be built of a fiberglass reinforced polymer (FRP) pultrusion. All pultrusion's shall be non-conductive, non-corrosive, rust proof and NSF listed. All doors shall be furnished with a replaceable aluminum braided heater wire, electronically monitored, and controlled as to initiation temperature, termination temperature and percentage of operation time as required. Install 2" x 4" 16-gauge stainless steel hat-channel full-width of the jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

- H. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side – interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob. Emergency Strobe Beacons are by Division 26.
- I. Provide an aluminum cove base at the interior and exterior of exposed panels for all floor assemblies.
- J. Floor Installations:
  - 1. **4" Recessed Exposed Factory Floor Installation (if required):**
    - a. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.
    - b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.
    - c. 4" commercial grade manufacturer's dura floor with diamond treadplate surface and marine grade plywood subfloor.
    - d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.
    - e. 1/2" sand leveling bed by G.C.
  - 2. **8-1/2" Recessed Floor Installation (if required):**
    - a. Factory floor in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.
    - b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.
    - c. 4" manufacturer's floor.
    - d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.
    - e. 1/2" sand leveling bed by G.C.
    - f. Concrete flooring and tile over insulation by Divisions 03/09.
  - 3. **12" Recessed Floor Installation (if required):**
    - a. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.
    - b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.
    - c. 4" manufacturer's floor.
    - d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.
    - e. 1/2" sand leveling bed by G.C.
    - f. Concrete flooring over insulation by Division 03:
      - i. Concrete mix: 5000 psi @ Freezers and 3000 psi @ Coolers.

- ii. No limestone or fly ash; fiberglass reinforced.
- iii. #3 rebar, set on 12" centers in both directions.
- iv. Center rebar vertically in wearing bed.
- v. 10" high concrete 45° angled wall curb at interior perimeter per food service details.
- g. Diamond treadplate wall panels on the interior and exposed exterior by 11 40 00. Refer to drawings for height. Coordinate diamond treadplate wall covering at the interior with angled wall curb.
- h. Ventilation Pipe Requirements by G.C.:
  - i. Bottom perforated vent pipes to be #40 PVC on six ft. max centers open on both ends with the thermostatically controlled fan on (1) end and perforated mesh on the opposite end of the fan at the exterior of the building.
  - ii. Vent pipes are to be turned parallel with the exterior wall - 180° turn down.
  - iii. Vent pipe openings to be held at 24" above grade or roof per design.
  - iv. Fans to be Grainger Manufacturer and sized per airflow needs. Airflow is to be sized based on the length and number of bends.
  - v. If no exterior wall is adjacent, vent pipes will route up and extend past the roof. Roof penetrations by Division 07.

4. **Surface Mounted Factory Floor Installation (if required):**

- a. 4" commercial grade manufacturer's dura floor with diamond treadplate surface and marine grade plywood subfloor.
  - b. 36" reinforced diamond treadplate internal ramp.
  - c. 10-gauge stainless steel threshold to provide a smooth transition to the interior walk-in assembly floor.
- K. Integrated, flush-mounted temperature monitor/alarm with sensor and probe-cord length required to extend from the exterior front of the assembly to a mounting position of the sensor within the evaporator return airstream. System to have an easy-to-read LCD with high and low alarm set points with audible and visual alerts for alarm conditions. System to include Adaptive Programming for automatic set point control. Wi-Fi connectivity is included for remote notifications of alarms such as power failure, high and low temperatures, entrapment, and door open. System to include a built-in panic alarm. The system is to be interconnected to the Building Automation System (BAS) or the Owner's Network (by Division 27) and to notify facility personnel of the district/owner choosing when activated.
- L. Heated Illuminated Push Button Panic Alarm with protective cover and Phenolic Label "PANIC ALARM" for entrapment **within Freezer** (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if 'inline' assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium). Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsections F. Division 26 (**Electrical**) and G. Division 27 (**Communication**) for additional information.
- M. KE2 Smart Access (unless otherwise specified). Confirm all component model numbers for complete installation and operation.

- N. LED surface-mounted light fixture, in quantity/arrangement shown on drawings. Light fixtures to be perpendicular to coils. Light fixtures wired to interior and exterior temperature control panel. Light fixtures are to be provided by Section 11 40 00 and installed by Division 26. Division 26 is to seal all conduit penetrations at light fixtures. KEC to verify that penetrations are sealed.
- O. Penetrations of Panels: To be sealed by factory installer and appropriate trade contractors, with Dow Corning 3-6548 silicone RTV foam, total depth of the panel. Trim excess flush. KEC to verify that all penetrations are sealed.
- P. Install closure panels and trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.
- Q. Compartment Entrance Doors: 36" x 78" nominal clearance unless otherwise noted.
1. Mount hinged doors on two Kason Model No. 1346; polished chrome-plated nylon cam-lift hinges.
  2. Hinge doors as indicated on drawings.
  3. Defrost heater: Thermostatically controlled and replaceable at the entire perimeter of all doors, except when using clear Lexan doors (in addition to door jambs). Defrost heaters to be wired for continuous service.
  4. 36" high x full-length diamond aluminum treadplate at front and rear of all hinged doors.
  5. 12" x 2" engraved phenolic plastic compartment identification sign in Architect's color selection with 1" letters, mounted above door window.
  6. 14" x 24" four-panel glass view window with heater and molded non-metallic inner and outer frame. The heater is to be wired and controlled via the door monitor for continuous service.
  7. Padlock/key provisions in the door latch with safety release mechanisms.
  8. Kason 1826 Intelli-Vent LED Heated Pressure Relief Ports with Dual Port Vent and Security Light. Locate One (1) 12" below ceiling on Cooler/Freezer common wall panel and One (1) 12" below ceiling on Cooler wall panel. If Cooler and Freezer are separate units, locate one on the Freezer wall panel as well, 12" below ceiling and mounted in the door frame assembly. All ports to have separate dedicated electrical connections and be wired for continuous service. Located and installed by Manufacturer.
  9. Kason Model No. 0487 (unless specified otherwise) Frost Free inside release with fiberglass rod and plastic flange with safety flow plastic knob – ADA compliant.
  10. Manual backup vacuum release mechanism to punch hole in Freezer panel assembly to release vacuum within Freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in panel accordingly to assist with opening of door in the event of entrapment (and failure of frost-free inside release button). Door panel to include knock-out section to assist with requirements. Release mechanism assembly to be built-in/mounted to the door assembly structural frame to minimize mechanism tear-out and/or failure. Handle to be painted yellow with phenolic label "Vacuum Pressure Release."
- R. Provide refrigeration calculations and refrigeration alarm to meet local jurisdiction code requirements.
- S. If air screens or air shields are specified above doors or on the interior of the assembly, the manufacturer must provide adequate blocking in panels to support these components and pre-wired electrical connections. Installer to coordinate location of door closure to not interfere with air screens or air shields. Clear-VU, swinging door assemblies, are not required if air shields are specified.
- T. S/S trim above walk-in assembly to conceal manufacturer ceiling grid.

- U. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment.
- V. Walk-in Assemblies to be installed by the PRE-APPROVED INSTALLERS listed below:
  - 1. QBR Refrigeration, 30083 Hwy 90 Blvd., Katy, TX 77493, Mr. Andy Spellins, 713-973-2875, [andy.spellins@qbrsales.com](mailto:andy.spellins@qbrsales.com)
  - 2. Machine Ice, 8915 Sweetwater Ln., Houston, TX 77037, Mr. Will Weaver, 281-448-7823
  - 3. Coolers Inc., 6922 Alder Dr., Houston, TX 77081, Mr. Lee Mamone, 713-665-8886

#### 2.34 WALK-IN COLD STORAGE ASSEMBLY REFRIGERATION SYSTEMS

- A. Unit Coolers: specified quantity and model, ceiling-hung by ½" OD nylon bolts with stainless steel washers and nuts. Insert hanger bolts through the plastic sleeve and seal penetration airtight.
  - 1. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drain pan outlet with union and cleanout plug and extension of 1" Type K copper drain line through wall panel to airgap fitting or floor drain under this Section.
  - 2. Slope drain line ½" per foot, trap at the exterior of assembly and turn down into the drain. Manifold drain lines of adjacent compartments wherever possible.
  - 3. Install drain line plastic sleeve through compartment wall, seal around drain line, and install stainless steel escutcheon with setscrews.
  - 4. Electric drain line heater cable (self-regulating 7 watts): on all unit coolers operating below 36°F., installed from coil drain line fitting to wall penetration under this Section. Heater cables: the minimum rating of 15 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2" loop spacing and interwire to unit cooler for continuous operation.
  - 5. Mounted, pre-piped, and pre-wired evaporator components:
    - a. Sporlan thermostatic expansion valve with external equalizer.
    - b. Shut-off valve at evaporator suction and liquid lines.
    - c. Sporlan "Catch-All" refrigerant filter/dehydrator on liquid line.
    - d. White Rogers 1609-101 adjustable thermostat with remote bulb positioned in return airstream of the evaporator.
    - e. Electrical disconnect switch in NEMA 4 enclosure.
    - f. **For any facility within 20 miles of a salt air environment:** Condenser and Evaporators to be built with Electrofin coating to retard salt air deterioration. Coils are to be coated with Technicoat 10-2 coating for protection against a salt air environment.
    - g. 110° Ambient Temperature Operation.
  - 6. Two (2) fan door activation switches to turn off evaporator coils when the door is opened.
- B. Refrigerant System Installation:
  - 1. Refrigerant Lines; Type "L" rigid copper tubing. Fittings: Wrought copper or brass designed for use with high-temperature solder. Piping joints: Made with silver solder (Sil-Fos). Piping: Properly suspended from and anchored to the structure with adjustable hangers 6' OC maximum. Suction lines: Sized to have a maximum pressure drop of two pounds in medium-temperature systems;

one pound in low-temperature systems. Liquid lines: Sized to give maximum pressure to prevent trapping of oil. Insulation on all suction lines: Armaflex insulation by Armstrong. ¾" thick at medium- temp 1" thick at low temp. Refrigerant lines in PVC conduit: Sealed at both ends with Dow Corning 3-6548 silicone RTV foam. The refrigeration system installer will wrap Exterior Refrigerant Lines in the self-fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum strapping and seals for applying aluminum jackets and covers according to the manufacturer's recommendations for a completely weather-tight covering.

C. Evacuation and Charging:

1. After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. Connections for evacuation: Following the manufacturer's recommendations.
2. Charging after the initial charge, which is contained in the condensing unit (R448A Non- CFC Ozone Depletion Refrigerant for medium and high temp units, R513A - Non- CFC Ozone Depletion Refrigerant on low temp units) – (Refrigerant must meet District Standards, Industry Standards, and local Codes): given through the charging valve in the high side passing all of the liquid refrigerants through a charging dehydrator. All charging lines and gauges must be purged of air before connection with the system. Refrigerant: unused and shall be delivered in clean containers. After the system is fully charged: start and place it in full operation.

D. Refrigeration system to be installed by the **PRE-APPROVED INSTALLERS** listed below:

1. QBR Refrigeration, Mr. Andy Spellins 30083 Hwy 90 Blvd., Katy, TX 77493, 713.973.2875, [andy.spellins@qbrsales.com](mailto:andy.spellins@qbrsales.com)
2. Machine Ice, Mr. Will Weaver, 8915 Sweetwater Ln., Houston, TX 77037, 281.448.7823
3. Coolers Inc., 6922 Alder Dr, Houston, TX 77081, Mr. Lee Mamone, (713) 665-8886

2.35 PRE-APPROVED KITCHEN EQUIPMENT CONTRACTORS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.

B. **Any contractor requesting inclusion within this bid must submit AIA form 305 a minimum of 14 days before the bid date for review or as required by Architect.**

1. Stafford Smith, Mr. JP Garcia, 7129 North Loop East, Houston, TX 77028, Phone: 713.892.5001, Email: [jpgarcia@staffordsmith.com](mailto:jpgarcia@staffordsmith.com)
2. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, Phone: 713.466.8722, Email: [aharman@txmetalequip.com](mailto:aharman@txmetalequip.com)
3. Kirby Restaurant Supply, Mr. Brian Kernan, 809 S. Eastman Road, Longview, Texas 75602, Phone: 903.757.2723, Email: [briank@kirbysupply.com](mailto:briank@kirbysupply.com)
4. Mission Restaurant Supply, Mr. Brian Mosher, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 210.354.0690, Email: [brianM@missionrs.com](mailto:brianM@missionrs.com)
5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 409.769.1199, Email: [terry@kommercialkitchens.com](mailto:terry@kommercialkitchens.com)
6. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: 501.455.2552, Email: [tim@supremefixture.com](mailto:tim@supremefixture.com)
7. Amundsen Commercial Kitchens, Mr. Lewis Beville, 105 Montie, Longview, TX 75604, Phone: 903.576.6354, E-mail: [lewis@afeok.com](mailto:lewis@afeok.com)

## 2.36 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS

- A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid. Pre-approved fabricators shown below shall not sub-out fabrication.
- B. **Any supplier requesting inclusion within this bid must submit AIA form 305 at least 14 days before the bid date for review or as required by Architect.**
  - 1. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, Phone: 713.466.8722, Email: [aharman@txmetalequip.com](mailto:aharman@txmetalequip.com)
  - 2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 832.767.5287, Email: [terry@kommercialkitchens.com](mailto:terry@kommercialkitchens.com)
  - 3. Mission Restaurant Supply, Mr. Brian Mosher, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 210.354.0690, Email: [brianM@missionrs.com](mailto:brianM@missionrs.com)
  - 4. CSS Manufacturing, Mr. Jared Woodard, 7430 Fairbanks North Houston Rd., Houston, Texas 77040, Phone: 832.444.6311, Email: [jared.woodard@css-mfg.com](mailto:jared.woodard@css-mfg.com)

## PART 3 - EXECUTION

### 3.1 DELIVERY AND INSTALLATION

- A. Supervision: Provide a skilled and proficient foreman or supervisor who shall remain on the job during the entire installation.
- B. Delivery: Coordinate with the progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:
  - 1. Field-Assembled Fixed Equipment integrated into the structure (e.g., walk-in assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job site when directed by the General Contractor and installed/protected accordingly.
  - 2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.
  - 3. Major Movable Equipment: delivered, when possible, to inventory in a secured area for interim job-site storage or, if the secured area is unavailable when fixed equipment installation/clean-up has been completed.
  - 4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) should be delivered only when the Owner is prepared to receive and inventory such items.
- C. Installation: performed by the manufacturer of custom fabricated fixtures.
  - 1. Assemble, square, level, and ready all items for the final utility connections.
  - 2. Cut neatly around obstructions to provide sanitary conditions.
  - 3. Where gaps of 1/4" or less occur adjacent to or between equipment, insert rope backing and smoothly apply General Electric construction sealant Series SE-1200 silicone mastic (silver color). Mask both sides of the gap for neat sealant application and remove excess. If space exceeds 1/4," neatly install 18-gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.



4. Refrigeration coil drain line runs to an indirect drain connection greater than 2" from the face of the wall or panel: Either of the following field procedures:
  - a. Trench the floor and provide a 6" wide x 2" deep 16-gauge stainless steel sloping (-1" to -2") trough from the face of the cooler/freezer wall to the body of the floor sink/floor drain. Trough: turned up 4" at the wall; ¾" flange with ½" turndown at both long sides. Set trough in waterproof mastic and seal 1" OD drain tube penetration into floor sink/floor drain at -2½" BFF. Patch the floor to match adjacent material/surface.
  - b. Provide 12" x 6" x 2" deep 16-gauge stainless steel condensate pan mounted to cooler/freezer wall at 6" AFF clear. Trench the floor and install a 1" OD drain line from the bottom of the pan to the body of the floor sink/drain. Slope drain line ¼" per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

1. Fabricated fixtures: Fiberboard or plywood taped to tops and exposed body panels/components.
2. Manufactured Equipment: Fiberboard or plywood taped as required by equipment shape and installation-access requirements.
3. Prohibited use of equipment: Tool and materials storage, workbench, scaffold, stacking area, etc.
4. Damaged Equipment: Immediately documented and submitted to the Owner with the Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

- A. Clean up and remove all debris from this Work from the job site as the installation progresses.
- B. Lubricate and adjust drawer slides, hinges, and casters.
- C. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.
- D. Clean or replace faucet aerators and line strainers.
- E. Touch-up damage to painted finishes.
- F. Start up and check the operation of all refrigeration systems for at least 72 hours before acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

- A. Carefully test, adjust, and regulate all equipment following the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments, and performance are in full compliance.
- B. Provide the Owner or food service Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected equipment items and attendees with the Owner at least two weeks before the demonstration starts.

3.4 FINAL OBSERVATION

- A. Final observation will be made when the Contractor certifies that they have completed their work, thoroughly reviewed the installation/operation of each item in the contract and found it to comply with the Construction Documents.

- B. Repetitive final observations (more than two) and all costs associated with it which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a \$70.00/hr and expense basis.

#### PART 4 - EQUIPMENT SCHEDULE

- 4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS: Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.
- 4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT: Arrangement and configuration as shown on Plans, Elevations, Detail Drawings, and outlined in Specifications.
- 4.3 REFER TO DRAWINGS: For unit quantities and plumbing, electrical or mechanical provisions are required, including the manufacturer's optional voltages, wattages, burner capacities, etc.
- 4.4 REFER TO PART 2 – PRODUCTS: For accessories, fittings, requirements, and procedures related to the listed buy-out and fabricated equipment.
- 4.5 ALTERNATE MANUFACTURER REQUIREMENTS: A specific product manufactured by the listed pre-approved equals shown under Section 4.7 Food Service Equipment are acceptable only if the specific product can evidence compliance with the specified line items and the contract documents (Refer to Section 1.6; Sub-Section A.).
- 4.6 RE-USED EXISTING EQUIPMENT IF PROVIDED IN THIS PROJECT
  - A. Existing equipment scheduled for re-use is to be inventoried and documented that equipment is in operating condition once Kitchen Contractor has taken ownership.
  - B. Provide pictures of all equipment once inventoried and issue them to the architect to ensure that equipment has not been damaged.
  - C. Verify the locations of all equipment with the owner.
  - D. Existing equipment that is to be reused may need parts or accessories for proper and complete operation. Submit a report listing all items with pricing for approval to allow complete installation.
  - E. Utility disconnection and re-connection: Under Divisions 22 and 26. Kitchen Contractor to verify utility requirements of existing equipment and coordinate with Foodservice Design Professionals (FDP) as required. If utilities shown on FDP drawings do not match the requirements of existing equipment – KEC is to relay that to FDP immediately. All utilities not scheduled for re-use must be capped and covered by required disciplines.
  - F. Disassembly, removal, transportation, and relocation: under this Section and scheduled with General Contractor. The owner's representative must be present and coordinate the date/time with the owner.
  - G. Thoroughly clean inside and out before relocation.
  - H. Review functional parts (e.g., doors, controls, heating elements, compressors, etc.) and submit a report of required repairs and cost estimates. Any finishes or equipment damaged due to construction will be repaired as required.
  - I. Existing equipment not scheduled for reuse is to be carefully removed/relocated by the Kitchen Contractor per the Owner's direction. Kitchen Contractor to coordinate the date/time with General Contractor and Owner.
  - J. Removal or replacement of existing equipment is to be scheduled for times of least interruption and inconvenience to the food service operation. Submit the proposed time frame schedule, task sequence, and process for approval before starting work.

- K. Kitchen Contractor to verify size and shape for all existing re-used equipment and coordinate with Foodservice Design Professionals (FDP) as required.
- L. Any modification(s) required/desired for re-used existing equipment to be verified by the Kitchen Contractor. Before the changes are made, all modifications must be approved by the Owner and Foodservice Design Professionals (FDP).
- M. The KEC is to verify and coordinate all the utility requirements with the construction documents as required. Refer to the general specifications regarding conflicts.

#### 4.7 FOOD SERVICE EQUIPMENT

- A. All equipment is to have a performance check from factory-authorized personnel. Warranties will begin on the day of the performance check.
- B. All equipment and internal components should be of domestic origin where possible.
- C. Architect to verify/coordinate the aesthetic options below (Food Service color, material, or signage selections) if these items are provided in this project:
  - 1. Countertops: Stone (stainless steel is provided unless otherwise specified)
  - 2. Tray slides: Corian or Stone (stainless steel is provided unless otherwise specified)
  - 3. Counter fronts: Ceramic tile, 3 Form, or Plastic Laminate
  - 4. Sneeze Guards: Stone insets
  - 5. General color, material and graphic selections:
    - a. Display Air Screen Merchandisers – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)
    - b. Bakery Display Cases – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)
    - c. Pass Thru or Reach In Holding Cabinets - Color selection: Powder Coat (Mfg.: True) or Plastic Laminate (Mfg.: Traulsen) (Stainless steel is provided unless otherwise specified)
    - d. Hanging Heat Lamps – Track and Fixture color selection
    - e. Heated Merchandisers
    - f. Portable Guide Rails – Stanchion and Belt color selection
    - g. Popcorn machine – Signage selection
    - h. Bottle Cooler – Signage selection
    - i. Graphics Package information
    - j. Hot Food Well covers
- D. Architect to verify/coordinate the finishes below:
  - 1. Walls: Ceramic Tile, Flat FRP, or Molded FRP (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)

2. Ceilings: Removable Vinyl Face Tile (Smooth, impervious, and easily cleanable as approved by local jurisdiction)
3. Floors: Tile, Epoxy, or Rubberized flooring system (Smooth, impervious, easily cleanable and slip resistant as approved by local jurisdiction) (Coordinate floor tile transition at serving lines)
4. Floors: Walk-in Assembly – Extend kitchen floor flush into Walk-in assembly with coved base
5. Furr Downs above Serving Counters

## FOODSERVICE EQUIPMENT

ITEM NO. 101

AIR SCREEN

QUANTITY 1

**Manufacturer:** Mars  
**Model:** STD248-1UA-OB standard ext.  
**Size and Shape:** Refer to drawings  
**Alternate:** Berner

1. Air curtain, STD2 series model, unheated, obsidian black exterior. Size unit to fit door.
2. Air Curtain to include Model #J0023 Controller Kit. Controller kit to come complete with plastic magnetic reed switch, surface mounted, .50 HP max, 115v/1-ph limit switch. The magnet to be mounted on the surface of the door jamb and the door.
3. Confirm clearance above door prior to installation. Air Curtain to accommodate door width and height.
4. 114000 to provide magnetic reed switch kit loose to General Contractor for installation by Division 26. Division 26 to route flexible conduit to j-box on cabinet. Routing to be clean and secured to building.
5. Provide Harsh Weather Cover if no awning or recessed door is provided.

ITEM NO. 102

COLD STORAGE ASSEMBLY

QUANTITY 1

**Manufacturer:** Thermokool  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** American Panel

1. Installation to be completed by Factory Approved / Authorized installer. Refer to Section 2.33 Submittal drawings to include factory approval letter or certificate.
2. Manufacturer to review final installation and provide a letter confirming installation meets manufacturer requirements.
3. Assembly to have 9'-6" interior clearance.
4. 304 #3 finish 20 gauge stainless steel finish where exposed, 26 gauge galvalume steel where concealed.
5. Factory floor with smooth aluminum finish, recessed in slab 8 1/2". Secure floor to wall assembly with cam-lock assembly. KEC to ensure the floor assembly is level prior to the wearing bed installation. Kitchens finished floor to extend to walk-in.
6. Threshold to be smooth and level with finished floor. - **Critical.**
7. Interior walls to be .040" aluminum, white embossed texture on walls.
8. Ceiling to be embossed textured .040" aluminum baked white enamel.
9. Two (2) 36" doors. Doors to be 18-gauge stainless steel, type 304 (18-8), #3 finish, with heated perimeter / door jambs / windows and threshold heaters. Each door to be equipped with 3'-0" high diamond tread kick plate on both sides of doors. Mount hinged doors on two (2) Kason model no. 1346 (or equal); polished chrome plated nylon cam-lift hinges.
10. Provide heated illuminated Push Button Panic Alarm with protective cover and Phenolic Label "PANIC ALARM" for entrapment within Freezer (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if 'inline' assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium). Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification.
11. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side - interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob.
12. The Cooler will have the standard control panel with standard panic button tied into the Owner's network for notification.

13. Provide Kason model no. 0487 Frost Free Inside release (or equal) for each cold storage door assembly. Fiberglass rod and plastic flange, with safety glow plastic knob, ADA compliant.
14. Manual backup vacuum release mechanism to punch hole in wall assembly to release vacuum within freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in wall accordingly to assist with opening of door assembly in the event of entrapment (and failure of Frost free inside release button). Wall panel to include a knockout section to assist with requirements. Release mechanism assembly to be built-in/mounted to the door assembly structural frame to minimize mechanism tear-out and/or failure. Handle to be painted yellow with phenolic label "Vacuum Pressure Release".
15. 18-gauge stainless steel, type 304 (18-8), #3 finish trim where adjacent to walls and enclosure panels that extend to 2" above finished ceiling.
16. Freezer One (1) lot LED light fixtures to operate in temperatures to -20 F. Lights to be installed perpendicular to coils.
17. Refrigerator- One (1) lot LED light fixtures. Lights to be installed perpendicular to coils.
18. 3'-0" high diamond tread plate at exposed exterior surfaces. Fasten to wall with stainless steel fasteners.
19. Provide door bumper at doors.
20. Compartments to have all electrical concealed within the walls or located above the ceiling.
21. Provide Manufacturers alarm/control system that includes hi/low limits . Route temperature sensor to be located to the side of evaporator coil.
22. Doors to be provided with CCI Industries, Inc., Clear-VU swinging door assemblies, Alternate: Kason.
23. K.E.C. to provide aluminum coved base to interior and exterior of assembly. Provide sealant between floor and wall panels.
24. All holes in assembly to be sealed by factory installer.
25. Kason 1826 Intelli-Vent LED Heated Pressure Relief Ports with Dual Port Vent and Security Light. Locate One (1) 12" below ceiling on cooler/freezer common wall panel and One (1) 12" below ceiling on exterior cooler wall. All ports to have separate dedicated electrical circuits. Pressure relief ports to be wired for continuous service. Relief port to be located and installed by Walk-in Manufacturer.
26. KEC to field verify all horizontal/vertical measurements and conditions at the building prior to fabrication or delivery of equipment.
27. KEC to provide 1-year walk-in panel installation warranty. KEC is responsible for overall install accuracy/quality and quality control of work performed regardless of installer or any field modifications due to building/construction conditions. KEC to provide Letter of Install Approval to FDP upon completed install.
28. Manufacturer to provide One Year Parts and Labor Warranty.
29. Interwiring of temperature monitor panel to master building alarm system or to the Owner's network. Technology department to provide all interfacing of alarm system and with the building alarm system. Conduit from refrigeration system to monitor by Division 26. Temperature Monitor installation at 4'-0" above finished floor. All conduit to be located above walk-in cooler/freezer ceiling. Exposed electrical conduit is not acceptable.
30. Manufacturer Representative to provide training on controls and inside emergency release mechanisms.

**ITEM NO. 103.1**

**COLD STORAGE REFRIGERATION SYSTEM**

**QUANTITY 1**

**Manufacturer:** RDT  
**Model:** ZS1-2 EcoSmart  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Air cooled system.
2. Scroll Compressors.
3. Cooler temperature to be +35 degrees.
4. Freezer temperature to be -10 degrees.

5. EcoSmart system on demand defrost.
6. KE2 Evap Controllers located per Owner requirements.
7. S/S covered housing.
8. A dedicated electrical connection to be provided for heated condensate drain line. Refer to electrical plan for location.
9. All exterior piping to be aluminum wrapped.
10. System to accommodate Item No. 102 Cold Storage Assembly.
11. S/S covered housing mounted to a 24" tall 1/8 galvanized angle iron frame anchored to concrete pad. Provide S/S skirting around frame.
12. Refrigeration rack accommodates 110 ambient temperatures.
13. Provide two (2) year parts and labor warranty for all parts and components (including third-party components that may be utilized).
14. Temperature alarm system to be tested and confirmed it reports to the police department prior to project turnover to Owner.
15. Run liquid line adjacent to the suction line, outside the insulation.
16. Refrigeration system to be provided per Cy Fair ISD's district standards.
17. **Special Instruction:** Mount condensing unit on common exterior rack. Refer to Architectural and Engineering drawings for exact location of remote unit. Coordinate routing of refrigeration lines and conduit with appropriate trades. Heat tape and insulate all drain lines. General Contractor to seal all building penetrations at refrigeration lines.

**ITEM NO. 104**

**COLD STORAGE SHELVING**

**QUANTITY 2**

**Manufacturer:** Metro  
**Model:** Metro Max Q  
**Size and Shape:** Refer to drawings  
**Alternate:** Cambro Premium

1. Each unit to be four (4) tiers high with open grid mats.
2. Four (4) 74" post per unit. Provide foot plates at all posts when assembly is supplied with walk-in floor.
3. Refer to drawings for size, width and lengths.
4. Quantity Two (2) to equal One (1) lot: all shelving shown within cold storage assembly.
5. Verify shelving requirements with approved submittal prior to ordering.

**ITEM NO. 105**

**DUNNAGE RACK**

**QUANTITY 16**

**Manufacturer:** Metro  
**Model:** Bow Tie Series  
**Size and Shape:** Refer to drawings  
**Alternate:** Cambro Premium

1. Size as shown.

**ITEM NO. 107**

**DRY STORAGE SHELVING**

**QUANTITY 1**

**Manufacturer:** Metro  
**Model:** MetroMax Q  
**Size and Shape:** Refer to drawings  
**Alternate:** Cambro Premium

1. Each unit to be five (5) tiers high with open grid shelving.
2. Four (4) 86" posts per unit.

3. Quantity One (1) to equal One (1) Lot: all shelving shown within the dry storage room.
4. Refer to drawings for size, width and lengths.
5. Verify shelving requirements with approved submittal prior to ordering.

**ITEM NO. 108**

**CAN RACK**

**QUANTITY 2**

**Manufacturer:** New Age  
**Model:** 1250CK  
**Size and Shape:** Refer to drawings  
**Alternate:** SPG

1. Three (3) sets 1255, of shelf inserts to accommodate #5 and #10 cans.
2. Four (4) casters with brakes.

**ITEM NO. 109.1**

**ICE MACHINE**

**QUANTITY 1**

**Manufacturer:** Manitowoc  
**Model:** IYT1500A/D-970  
**Size and Shape:** Refer to drawings  
**Alternate:** Hoshizaki

1. Stainless steel bin.
2. Stainless steel legs.
3. Provide bin adapter kit as required.
4. Provide Luminice II Virus and Bacteria Inhibitor.
5. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to Ice Machine.
6. KEC to coordinate routing of water lines from the ice machine to the remote water filter system.
7. One (1) pre-filter and water filter sized to manufactures recommendations. Provide two (2) sets of replacement filters. Mount on wall adjacent to ice machine in an easily accessible location.
8. Self cleaning option (iAuCS).
9. External Scoop holder (K00461).
10. Provide 3M HF40-S water filter only. Mount on wall adjacent to ice machine in an easily accessible location. Locate bottom of filter at 72" A.F.F.
11. Location of related floor sinks are critical. Recommend block out of floor sinks. G.C. and 11 40 00 to verify location prior to concrete pour.
12. **Special Instruction:** Coordinate cord and cap with receptacle. Water supply to filter to be hard copper plumbed. 60" long flex hose from filter to ice maker. Interconnection thru water filter to ice machine and final connection by Division 22. Water filter overflow tube to be strapped to back side of ice machine and extend to 1" above floor sink.

**ITEM NO. 110**

**CLOTHES WASHER**

**QUANTITY 1**

**Manufacturer:** Owner Furnished  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Contractor to provide current model numbers at the time of delivery.
2. Top load washer.
3. 4.2 cu. Ft. capacity, minimum.
4. Six (6) cycle, two (2) speed washer.
5. White acrylic finish.



6. Cord and plug.
7. Water and drain connection hoses as required.

**ITEM NO. 110A CLOTHES DRYER**

**QUANTITY 1**

**Manufacturer:** Owner Furnished  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Front load dryer.
2. 3.4 cu. ft. capacity, minimum.
3. Seven (7) cycle-four (4) temperature, Dryer.
4. White acrylic finish.
5. Cord and plug.
6. Vent kit with dryer.
7. Contractor to provide current model numbers at the time of delivery.

**ITEM NO. 111 CHEMICAL SHELF**

**QUANTITY 5**

**Manufacturer:** Metro  
**Model:** MetroMax Q  
**Size and Shape:** Refer to drawings  
**Alternate:** Cambro Premium

1. Each unit to be four (4) tiers high with open grid mats.
2. Four (4) 74" posts per unit.

**ITEM NO. 121 THREE COMPARTMENT PREP SINK W. DISPOSER**

**QUANTITY 2**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Top: 14 gauge type 304 S/S marine edge with 2" turndown at free sides.
2. Open base construction.
3. 10" high splash where adjacent to walls/fixtures.
4. Three (3) 24" x 26" x 15" deep sink compartments.
5. One (1) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for ¾" hot and cold water connections.
6. Two (2) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. Provide One (1) T&S model no. B-0133-EE-CR-8C pre-rinse, **two (2)** B-0108-C spray head, two(2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
8. 16 gauge S/S undershelf per drawings.
9. Disposer - installed in top integrally welded disposer cone. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top for disposer control panel ground and polished to match top.
10. 12" deep single post mounted overshelf at 18" above counter top, punched to accommodate spray rinse.

11. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x 1/4" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Verify height with owner.
12. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray nozzle by owner.
13. Omit rear rail at sink compartments, disposer and front rail at hose bibb.
14. Two (2) "Richlite" 1/2" thick removable sink covers installed at each sink. Weld 1/4" bar stock, set 5/8" below work surface at all four corners for support of sink covers. Two (2) finger holes per board.
15. Provide top and bottom c-channel support storage for sink covers at right or left end of counter.
16. One (1) Edlund model no. S-11 Manual can opener, mounted on raised platform.
17. Flanged feet at front only.
18. Seal at all splash penetrations.

**ITEM NO. 123**

**DISPOSER-CONE MOUNT**

**QUANTITY 4**

**Manufacturer:** Master  
**Model:** C-3-L-BC-18-RAC2-PF  
**Size and Shape:** Refer to drawings  
**Alternate:** Red Goat

1. Fixed nozzle.
2. Delete standard syphon breakers and provide T & S B-0456-04 vacuum breakers and mount 6" from tabletop to base of breaker.
3. Solenoid valve.
4. Flow control.
5. Model no. RAC2 control panel.
6. Auto-reverse.
7. Dejamming tool.
8. Install vacuum breaker in splash
9. S/S cone cover.
10. Perforated silver saver and disposer cone with scrap ring.
11. Two (2) Swirl inlet located in disposer cone at a 45 degree angle.
12. GC to pipe 1/2" cold water to disposer body and swirl inlets. Excess electrical cord to be secured to fabrication as required. Install into counter by section 114000.

**ITEM NO. 124**

**WORKTABLE W. OVERSHELF**

**QUANTITY 4**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Top: 14 gauge type 304 S/S top with 6" high backsplash at wall and 2" turndown at free sides.
2. Open base construction.
3. 16 gauge S/S overshef post mounted 18" above working surface.
4. 16 gauge S/S undershef.
5. Two (2) 20" W x 20" L drawer assemblies. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
6. Close back of splash when exposed.

**ITEM NO. 128**                      **UTILITY CART**                      **QUANTITY 1**

**Manufacturer:** Lakeside  
**Model:** 522  
**Size and Shape:** Refer to drawings  
**Alternate:** Piper

1. Four (4) N.S.F. approved non-marking casters, Two (2) with brakes.
2. Extended perimeter bumper.

**ITEM NO. 129**                      **WORKTABLE W. S.BAR UT.RACK**                      **QUANTITY 5**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Top: 14 gauge type 304 S/S, 2" turn down at free sides.
2. Open base construction.
3. 16 gauge S/S undershelf.
4. Two (2) 20" W x 20" L drawer assemblies. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
5. Flanged feet.
6. Post mounted utensil rack, extend 1-5/8" diameter S/S post from cross rail, thru top to 78" A.F.F. and weld full length x 2" x 1/4" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Verify height with Owner.
7. Provide a duplex receptacle and housing mounted below countertop per drawings. Interconnect and prewire a 5'-0" cord and plug out of receptacle housing for plugging into ceiling drop cord receptacle. 114000 and Div. 26 to coordinate location of drop cord receptacle.

**ITEM NO. 130**                      **WORKTABLE NO OVERSHELF**                      **QUANTITY 2**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Top: 14 gauge type 304 S/S, 6" high backsplash at walls, 2" turndown at free sides. Close back of splash when exposed.
2. Open base construction.
3. 16 gauge S/S undershelf.
4. One (1) 20" W x 20" L drawer assembly. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
5. 6" S/S adjustable feet.

**ITEM NO. 138**                      **PAN RACK**                      **QUANTITY 13**

**Manufacturer:** Cres Cor  
**Model:** 207-UA-12AD  
**Size and Shape:** Refer to drawings  
**Alternate:** Lakeside

1. Four (4) 5" casters.
2. Adjustable universal slides on 1-1/2" centers.
3. Corner bumpers.

**ITEM NO. 151**

**FIRE PROTECTION SYSTEM**

**QUANTITY 5**

**Manufacturer:** Ansul  
**Model:** R102  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Duct and plenum protection to exhaust hood.
2. Surface protection for cooking equipment.
3. Locate remote fire pulls as recommended by Fire Marshal.
4. One (1) lot Mechanical gas valve (maximum diameter as required). Size as required. Furnished by Section 114000, installed by Division 22. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements prior to submittal review. All conduits to be recessed within wall, SURFACE MOUNTING WILL NOT BE ACCEPTED.
5. System to meet U.L. 300 requirements.
6. Provide one (1) hand held Type 'K' and ABC 6 liter fire extinguisher per Ansul System, surface wall mounted. Verify mounting locations as required.
7. Exposed pipe threads are unacceptable.
8. All exposed piping to be chrome plated.
9. All hood penetrations to have U.L. listed "Quick Seal". Provide s/s escutcheons at all hood penetrations.
10. Provide phenolic I.D. labels for exhaust hood, remote fire pull, light/fan switches and fire protection system.
11. Provide a manufacturer performance test and report that verifies this system is fully operational.
12. Provide s/s cabinet as shown on plan.
13. Installer to provide one (1) Ansul system per exhaust hood, review drawings and provide systems as required.
14. Install hand held extinguishers, maximum of 3'-2" A.F.F. to top of unit.

**ITEM NO. 152**

**EXHAUST HOOD**

**QUANTITY 1**

**Manufacturer:** Mod-U-Serve  
**Model:** W-CPB  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Size and shape as per plan.
2. Supply Air. Ceiling mounted supply plenum. Coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
3. U.L. Listed and fire rated 48" recessed LED lights located within the hood canopy. To meet minimum requirements of 50' candles of illumination.
4. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
5. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
6. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
7. All 18 gauge S/S construction. S/S finish where exposed.
8. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.

9. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
10. S/S filters and grease cup. Provide filter removal tool.
11. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
12. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
13. S/S c-channel closure panel from top of hood to ceiling.
14. S/S filler panel between hoods if back-to-back.
15. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
16. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
17. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
18. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
19. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
20. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
21. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
22. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

**ITEM NO. 153**

**EXHAUST HOOD**

**QUANTITY 1**

**Manufacturer:** Mod-U-Serve  
**Model:** W-CPB  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Size and shape as per plan.
2. Supply Air. Ceiling mounted supply plenum with light fixtures, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
3. U.L. Listed and fire rated 48" recessed LED lights located within the hood canopy. To meet minimum requirements of 50' candles of illumination.
4. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
5. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.

6. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
7. All 18 gauge S/S construction. S/S finish where exposed.
8. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
9. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
10. S/S filters and grease cup. Provide filter removal tool.
11. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
12. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
13. S/S c-channel closure panel from top of hood to ceiling.
14. S/S filler panel between hoods if back-to-back.
15. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
16. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
17. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
18. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
19. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
20. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
21. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
22. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

**ITEM NO. 154**

**EXHAUST HOOD**

**QUANTITY 1**

**Manufacturer:** Mod-U-Serve  
**Model:** W-CPB  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Size and shape as per plan.
2. Supply Air. Ceiling mounted supply plenum with light fixtures, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
3. U.L. Listed and fire rated 48" recessed LED lights located within the hood canopy. To meet minimum requirements of 50' candles of illumination.

4. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
5. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
6. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
7. All 18 gauge S/S construction. S/S finish where exposed.
8. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
9. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
10. S/S filters and grease cup. Provide filter removal tool.
11. 1/2" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
12. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
13. S/S c-channel closure panel from top of hood to ceiling.
14. S/S filler panel between hoods if back-to-back.
15. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
16. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
17. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
18. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
19. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
20. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
21. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
22. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

**ITEM NO. 155**

**EXHAUST HOOD**

**QUANTITY 1**

<b>Manufacturer:</b>	Mod-U-Serve
<b>Model:</b>	W-CPB
<b>Size and Shape:</b>	Refer to drawings
<b>Alternate:</b>	---

1. Size and shape as per plan.

2. Supply Air. Ceiling mounted supply plenum with light fixtures, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
3. U.L. Listed and fire rated 48" recessed LED lights located within the hood canopy. To meet minimum requirements of 50' candles of illumination.
4. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
5. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
6. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
7. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
8. All 18 gauge S/S construction. S/S finish where exposed.
9. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
10. S/S filters and grease cup. Provide filter removal tool.
11. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
12. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
13. S/S c-channel closure panel from top of hood to ceiling.
14. S/S filler panel between hoods if back-to-back.
15. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
16. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
17. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
18. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
19. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
20. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
21. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
22. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

**ITEM NO. 161**

**CONVECTION OVEN- GAS DBL**

**QUANTITY 7**

**Manufacturer:** Blodgett  
**Model:** DFG-200 DBL  
**Size and Shape:** Refer to drawings



**Alternate:** Vulcan

1. S/S front, top and sides.
2. Two (2) 1/2 HP 2-speed motors.
3. Natural gas.
4. SSI-M solid state infinite control with manual timer.
5. Electronic spark ignition.
6. Five (5) oven racks per compartment.
7. Dual pane thermal windows.
8. Simultaneous door operation.
9. Heavy duty casters, two (2) with brakes.
10. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48" Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
11. Dedicated gas connections, do not manifold.
12. Shunt trip breaker by Division 26.
13. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

**ITEM NO. 162 CONVECTION STEAMER - GAS DBL**

**QUANTITY 5**

**Manufacturer:** Accutemp  
**Model:** N6120E DBL  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. 6 (2.5" X 12" X 20") hotel pan capacity per unit.
2. Digital controls, with digital temperature display.
3. Independent digital electronic timer with programmable presets.
4. Water and drain connections for the connected model. Provide T&S water hose only. Drain hose to be steam rated.
5. Provide 3M water filter system: twin manifold with WAC RESIN softening cartridge.
6. One (1) year parts and labor warranty.
7. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48" Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
8. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to steamer,color coded for filtered and non-filtered water.
9. Drain watering tempering kit shipped loose to Contractor.
10. KEC to coordinate filtered and unfiltered water with steamer, do not connect filtered water to unfiltered water connection.
11. Coordinate location; Floor sink to be outside equipment footprint and outside steam-free zone. Division 26 to provide shunt trip breaker.
12. 5' power cord with plug indicated.

**ITEM NO. 165A TWO BURNER RANGE**

**QUANTITY 1**

**Manufacturer:** Southbend  
**Model:** P16C-X  
**Size and Shape:** Refer to drawings

**Alternate:** Vulcan

1. S/S sides and front.
2. Cabinet base with removable shelf.
3. Removable cast iron grates. 11 40 00 to clean and season grates prior to installation/product demonstration.
4. Removable drippings tray.
5. 1" rear gas connections.
6. 5" gas flue riser if unit is at Production wall.
7. Casters with brakes (2 locking).
8. External pressure regulator.
9. S/S front end caps at manifold.
10. Provide integral model no.P8C-S spreader cabinet and T&S faucet model no. 43-073. Provide heat shield at faucet.
11. Provide Battery Spark Ignition and Flame Failure.
12. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48" Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
13. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

**ITEM NO. 174**

**CONVEYOR OVEN - DBL**

**QUANTITY 2**

**Manufacturer:** Lincoln  
**Model:** 1116-000-U  
**Size and Shape:** Refer to drawings  
**Alternate:** Middleby Marshall

1. Fast Bake kit. Double Stack unit. Refer to drawings for belt direction.
2. Reverse direction switch for the Conveyor.
3. Two (2) ovens stacked.
4. Portable stand with casters, two (2) with brakes.
5. Each oven to have 12" Entrance/Exit takeoff shelves with stop lip.
6. Glass access windows
7. Insulated S/S top.
8. One (1) gas pressure valve for each oven.
9. Cord and plug assembly.
10. Shunt trip breakers furnished and installed by Division 26.
11. Coordinate routing of ansul system drop with conveyors.
12. All table heights adjacent to pizza ovens are to be adjusted to match pizza oven conveyor height of bottom section.
13. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48" Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
14. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

**ITEM NO. 187**

**PASS-THRU HEATED CABINET- 2 SECTION**

**QUANTITY 8**

**Manufacturer:** Traulsen  
**Model:** AHF-232WP-HHS  
**Size and Shape:** Refer to drawings  
**Alternate:** Utility

1. Anodized aluminum interior and S/S exterior.
2. Interior lights with bulbs.
3. Exterior digital thermometer.
4. Locking hardware.
5. EZ-Clean Tray racks, for 18" x 26", 14" x 18" or 12" x 20" pans. Provide a total of (12) levels for each section.
6. 6" high adjustable S/S legs.
7. Furnish startup and Six (6) years parts and labor warranty.
8. Controls mounted on kitchen side.
9. Half height doors hinged as per plan. Stainless doors located on kitchen side and server side.
10. Re-hinging feature.
11. Omit plug. Unit to be Hard Wired.
12. **Special Instructions:** Provide opening in wall 2" taller than equipment and 2" wider, KEC to coordinate with GC as required. Trim is not to be secured to the equipment.

**ITEM NO. 188**

**PASS-THRU REFRIGERATOR - 1 SECTION**

**QUANTITY 8**

**Manufacturer:** Traulsen  
**Model:** AHT-132WPUT  
**Size and Shape:** Refer to drawings  
**Alternate:** Utility

1. Anodized aluminum interior and S/S exterior.
2. Interior lights with bulbs.
3. Exterior digital thermometer.
4. Locking hardware.
5. EZ-Clean Tray racks, for 18" x 26", 14" x 18" or 12" x 20" pans. Provide a total of (12) levels for each section.
6. 6" high adjustable S/S legs.
7. Furnish start-up and Six (6) year parts and labor warranty.
8. Controls mounted on kitchen side.
9. Five (5) Year compressor warranty.
10. Half height doors hinged as per plan. Stainless doors located on kitchen side and server side.
11. Re-hinging feature.
12. Omit plug. Unit to be Hard Wired.
13. **Special Instruction:** Provide opening in wall 2" taller than equipment and 2" wider, KEC to coordinate with GC as required. Trim is not to be secured to the equipment.

**ITEM NO. 201.1**

**SERVING COUNTER-CONTINUOUS**

**QUANTITY 8**

**Manufacturer:** Countercraft  
**Model:** ---  
**Size and Shape:** Refer to drawings

**Alternate:**

Mod-U-Serve, Master Fabricators

1. **CONSTRUCTION BASE:**

2. Continuous semi-open base, angle iron frame construction; utility chase within the counter. All electrical conduits and plumbing are to be within utility chase as required - utility chase to be fully accessible from the operator side of the counter with removable stainless-steel panels.
3. All electrical is to be pre-wired to the load center. Electrical is to be located in an electrical conduit pipe, and flex conduit is to be kept to a minimum. Exposed conduit will not be accepted. All wiring is to be numbered at all junctions per circuit. A wiring diagram is to be provided at each load center door. All receptacles mounted in the counter are to be recess mounted and labeled.
4. Convenience outlet to be provided at each in counter control panel.
5. Cashier stations to be integral with counter, closed base when located on the customer side of counter, open base when located on the operator side of the counter. Provide lockable cashier drawer with cash till, undershelf to accommodate owner's POS System, and an outlet to accommodate POS system and data line.
6. Stainless steel removable intermediate shelves and fully welded undershelves where possible.
7. Dedicated recessed receptacle to accommodate beverage merchandisers; coordinate location with drawings.
8. Provide a remote on/off switch for beverage merchandisers if the standard location is not accessible.
9. Dedicated receptacle for any/all countertop equipment with grommets holes. Coordinate location with equipment.
10. Adjustable kickplates.

11. **COUNTERTOP FINISHES:**

12. 14-gauge Stainless Steel top at 34" aff.

13. **TRAY SLIDE OPTIONS:**

14. Tray slide to be at 34" AFF.
15. Stainless steel tray to be flat.
16. LED Tray slide lights. Provide an on/off switch at the cashier's station.

17. **COUNTER COMPONENTS:**

18. One (1) lot Hatco HWBIBRT-FULD 1200-watt bottom mount insulated hot food wells located per drawings. Recess countertop at hot food wells to accommodate sheet pan. Manifold all drains to one open/close valve located below the counter in an accessible location. **QUANTITIES AND SIZES PER PLANS.**
19. Deck mount single pantry fill faucet T&S Model no. B-0208.
20. Manifolded drains lead to a single 3/4" turn ball valve mounted in a full stainless-steel housing. Drain valve is to be located on the operator's side for ease of access.
21. One (1) lot Hatco drop in mechanical cold pan, sized per plan. **QUANTITIES AND SIZES PER PLANS.**
22. Silverking drop-in ice cream dispenser. **QUANTITIES AND SIZES PER PLANS.**
23. Full size Bon Chef (Bonstone, color: Black) hot and cold food well covers. Qty. 9 per line.
24. Stainless steel louvered panels to be provided on the operator's side only at compressor locations. Louvers to be provided per the manufacturer's minimum requirements.
25. One (1) LOT Frost top surface located in sneeze guard glass shelf, refrigeration to be self-contained with compressor housing located at undershelf. Refer to drawings for sizes. **QUANTITIES AND SIZES PER PLANS.**

26. **SNEEZE GUARDS:**

27. CounterCraft BGA sneeze guards, mirror finish, single tier at hot food wells, and two-tier at cold pans/frost tops. 3/8" Tempered glass. Height to be 18" above countertop. Glass to be adjustable to accommodate self and full-service operation. Heat lamps with lights located at hot food well and heated tops, lights over the cold sections. Size to accommodate equipment. Provide mirror finishes. All Sneeze Guards to meet all NSF and local health code requirements.
28. End glass to be provided to adjust with the front glass and brackets to maintain all NSF and local health codes.

29. Sneeze guards to be secured to base of counter and welded to countertop. If stone top construction, extend thru countertop and secure to base, provide matching color sealant to match countertop.
30. **COUNTER FRONT FINISHES:**
31. Backer board finish installed by the manufacturer to accept tile. Tile by counter manufacturer – coordinate color/pattern with Owner and Architect.
32. Counters to be factory installed, Manufacturer to provide floor template and coordinate with server walls, furr downs, electrical and plumbing locations. KEC To coordinate installation and any site conditions with the Trade/General Contractor as required.
33. Manufacturers are to bid all items per specifications; deviations from the specified manufacturers or fabrication will not be accepted.

**ITEM NO. 211                      DROP FRONT MILK COOLER - 12 CASE**

**QUANTITY 4**

**Manufacturer:** Mod-U-Serve  
**Model:** MCT-DM2  
**Size and Shape:** Refer to drawings  
**Alternate:** Traulsen

1. 18-gauge S/S fully welded liner.
2. 20-gauge S/S exterior.
3. Double pan insulated doors.
4. High pressure insulated foam.
5. 5" casters, two (2) with brakes.
6. ½" S/S nipple drain.
7. Locking mechanism.
8. Cord and plug. NEMA - 5-15P.
9. Corner bumpers.
10. 12 case capacity.
11. Strip curtains.
12. **Special Instruction:** Coordinate location of electrical receptacle so as to not interfere with location of milk dispenser.

**ITEM NO. 214                      CASH REGISTER**

**QUANTITY 8**

**Manufacturer:** Owner Furnished  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

**ITEM NO. 215                      GUIDE RAIL**

**QUANTITY 8**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. 1-5/8" O.D. stainless steel tubular guide rails with 1-5/8" uprights set in sleeves set in concrete at maximum 4'-0" on center.
2. Top of rails to be 34" A.F.F.
3. Section 114000 to coordinate guide rails with ADA requirements.

**ITEM NO. 249**

**THREE COMPARTMENT SINK WITH DISPOSER**

**QUANTITY 1**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Top: 14-gauge S/S 3" high 1-1/2" rolled rim at free sides, 10" high splash at walls.
2. Open base construction.
3. Omit rear rail at sink.
4. One (1) 30" x 26" x 15" and two (2) 24" x 26" x 15" deep sink compartments.
5. Two (2) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for 3/4" hot and cold water connections.
6. Three (3) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. 12" deep single post mounted perforated overself mounted at 18" above counter top.
8. 18-gaugebutt joint wall panel from splash to underside of shelf.
9. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x 1/4" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center.
10. Omit front rail at hose bibb.
11. 16-gauge S/S underself as per drawings.
12. Flanged feet at front only of counter.
13. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

**ITEM NO. 250.1**

**CONVEYOR DISHMACHINE W. BUILT-IN BOOSTER**

**QUANTITY 1**

**Manufacturer:** Hobart  
**Model:** CL44-BAS  
**Size and Shape:** Refer to drawings  
**Alternate:** Champion

1. 44" Conveyor dishmachine with built-in water tempering kit and built-in booster heater.
2. Full display touchscreen control.
3. Prewired 15 KW Electric tank heat.
4. Booster Heater built-in 18KW.
5. Programmable, automatic dosing, pumped delime system.
6. Built-in Drain water tempering kit. Drain Water Tempering kit to be installed by Hobart Service.
7. Verify direction of dishmachine with drawings.
8. One (1) Year Extended warranty - One (1) Year parts and labor.
9. One (1) Year Extended warranty on booster heater - One (1) Year parts and labor.
10. Interior Chamber height to be 4" taller than standard.
11. Single Point Connection, including Motors, Controls and Tank Heat, and Internal Booster Heater.
12. Two (2) vent cowls with 4 x 16 vent and damper. Provide 18 gauge stainless steel seamless duct risers 6" above finish ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel flange with all corners welded.
13. One (1) table limit switch with stainless steel cover to conceal back. Provided by Manufacturer / Installed by Div. 26.
14. Four (4) 20"x20" Peg racks.
15. Four (4) 20" x 20" sheet pan racks.
16. Two (2) 20" x 20" combination racks.

17. Vent fan controls.
18. Peak Rate of drain flow = 38 gpm. Division 22 to provide and install backflow preventor between booster heater and filter. Final connection by Division 22. Coordinate location of electrical disconnects on free wall.
19. Provide Scaltrol Filter model #HSC-100 for Booster Heater. System to be located in an accessible location.

**ITEM NO. 254**

**SOILED & CLEAN DISHTABLE**

**QUANTITY 2**

**Manufacturer:** Custom Fabricated  
**Model:** ---  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Top: 14 gauge type 304 S/S 3" high 1-1/2" rolled rim at free sides. 10" high splash at walls.
2. 14 gauge S/S recessed deposit shelf. Extend shelf through opening to be flush with wall at deposit side. Turn shelf down 2" at front with 3/4" return at bottom (either scribed into partition or forming reveal). Shelf: integral with dishtable. Provide Component Hardware E32-4900 drain - extend drain line to floor sink.
3. 18 gauge butt joint wall panel from splash to underside of shelf.
4. Install Disposer as shown. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top and polished to match top for disposer control panel.
5. Provide One (1) T&S model no. B-0133-EE pre-rinse, B-0108-C spray head, two (2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
6. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray rinse by owner.
7. One (1) 18" disposer cone.
8. Provide 1/2" slope in top towards dishmachine per the general specifications.
9. S/S corner filler at backsplash; slope to dishtable.
10. S/S cover to conceal table limit switch.
11. 2 1/2" backsplash at dishmachine portion, single thickness of s/s will not be accepted.
12. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

**ITEM NO. 255**

**MOBILE DRYING RACK**

**QUANTITY 6**

**Manufacturer:** Metro  
**Model:** PR48VX3  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Four (4) tier, includes two (2) drop-ins and (1) cutting board/tray drying rack, built in Microban antimicrobial product protection.
2. Two (2) no. 5MPX casters per unit.
3. Two (2) no. 5MPBX locking casters per unit.

**ITEM NO. 801**

**TRANSPORT CARTS**

**QUANTITY 4**

**Manufacturer:** Cres Cor  
**Model:** 150051  
**Size and Shape:** Refer to drawings  
**Alternate:** New Age

1. Units are modified to meet Cypress Fairbanks I.S.D.'s requirements.

2. Four (4) 6" N.S.F. approved non-marking casters. Two (2) with brakes.
3. Correctional construction on pan door.
4. Gravity type latch.
5. Five (5) years parts warranty.

**ITEM NO. 802                      WALL BUMPER**

**QUANTITY   1**

**Manufacturer:**                      Pawling  
**Model:**                                EB-4  
**Size and Shape:**                      Refer to drawings  
**Alternate:**                              ---

1. Bumper rail located per drawings at 10" and 35" A.F.F.
2. End caps and outside corners as needed.
3. Provide black bumper rails per CFISD.
4. Quantity One (1) to equal One (1) Lot: to be located on all exposed wall throughout kitchen.
5. Provide at exposed face of walk-in.

**ITEM NO. 803                      MOP & BROOM RACK/TRENCH LINER**

**QUANTITY   4**

**Manufacturer:**                      Tough Guy/Trench Liner  
**Model:**                                1ECL5  
**Size and Shape:**                      Refer to drawings  
**Alternate:**                              ---

1. Provide four (4) racks per plan.
2. S/S trench liner by 11 40 00. Installation by G.C. Custom fabricated or IMC/Teddy. IKG grating type "D". Grate to be provided in 2 equal sections. 1-1/2" x 3/16" bearing bars and perimeter frame. 14 gauge S/S liner. Klein no. 1834-1010-100 basket drain. Klein no. 1870-1001-3251 safety chain.
3. Location of trench liner is critical G.C. and 11 40 00 to verify location prior to concrete pour. Recommend block out of trench liner area.

**ITEM NO. 804                      S/S CORNER GUARDS-FULL HEIGHT**

**QUANTITY   1**

**Manufacturer:**                      Advance Tabco  
**Model:**                                FAB-X  
**Size and Shape:**                      Refer to drawings  
**Alternate:**                              ---

1. Full height, at all exterior corners throughout kitchen.

**TEMPORARY COLD STORAGE**

**ITEM NO. 104                      COLD STORGE SHELVING**

**QUANTITY   2**

**Manufacturer:**                      Owner Furnished  
**Model:**                                ---  
**Size and Shape:**                      Refer to drawings  
**Alternate:**                              ---



**ITEM NO. 112                      TEMPORARY WALK-IN COOLER**

**QUANTITY 2**

**Manufacturer:** Polar Leasing  
**Model:** DT820PD  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Two (2) 8'x20' units located per plan.
2. Heavy duty non-skid floor.
3. Lockable door latch.
4. Self closing hinges.
5. Hasp lock.
6. Safety release handle.
7. Heated door jamb
8. Door closer.
9. Sweep seal.
10. Light switch/pilot light.
11. Interior lighting.
12. Stainless steel kickplate.
13. Forklift capable frame.
14. Ramp at exterior door(s) as required.
15. One (1) Modularm, model 75LC per CFISD requirements for temperature monitoring. Unit to be mounted on outside of assembly, located per plan.
16. Special Instruction: Third party service agreement to be included as part of lease contract. Unit to be installed on level surface.

**ITEM NO. 112                      TEMPORARY WALK-IN FREEZER**

**QUANTITY 2**

**Manufacturer:** Polar Leasing  
**Model:** DT820PD  
**Size and Shape:** Refer to drawings  
**Alternate:** ---

1. Two (2) 8'x20' units located per plan.
2. Heavy duty non-skid floor.
3. Lockable door latch.
4. Self closing hinges.
5. Hasp lock.
6. Safety release handle.
7. Heated door jamb
8. Door closer.
9. Sweep seal.
10. Light switch/pilot light.
11. Interior lighting.
12. Stainless steel kickplate.
13. Forklift capable frame.
14. Defrost timer.
15. Heated relief port.

16. Heated Freezer door.
17. Ramp at exterior door(s) as required.
18. One (1) Modularm, model 75LC per CFISD requirements for temperature monitoring. Unit to be mounted on outside of assembly, located per plan.
19. Special Instruction: Third party service agreement to be included as part of lease contract. Unit to be installed on level surface.

**END OF FOODSERVICE EQUIPMENT**



SECTION 11 61 33

THEATRICAL RIGGING SYSTEMS AND STAGE DRAPERIES

PART 1 - GENERAL

1.1 SECTION SUMMARY

- A. This specification describes the installation of the theatrical rigging equipment and stage drapery tracks at the Drama Room.

1.2 RELATED DOCUMENTS

- A. Theatre Rigging Drawings ("TR" Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.

1.3 SECTION INCLUDES

- A. Coordination, provision, installation, inspection, commissioning, testing, documentation, instruction and warranties of Theatrical Rigging Systems.
- B. Plant, materials, equipment, transport and labor necessary to accomplish this and have a complete and proper System.
- C. Also includes:
  - 1. Required licenses and permits including payment of charges and fees.
  - 2. Any required fees for testing, documenting, and notary public services.
  - 3. Verification of dimensions and conditions at the job site.
  - 4. Provision of required pre-installation submittals and project record manuals.
  - 5. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
  - 6. Extension of electrical service, including ground, to equipment locations.

1.4 RELATED WORK

- A. Section 11 61 62: Theatrical Lighting Systems

1.5 REFERENCES

- A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
  - 1. American Iron and Steel Institute (AISI),
  - 2. American National Safety Institute (ANSI),
  - 3. American Society of Mechanical Engineers (ASME),
  - 4. American Society of Testing and Materials (ASTM),
  - 5. National Electrical Manufacturer's Association (NEMA),
  - 6. Occupational Safety and Health Administration (OHSA),
  - 7. Underwriters Laboratories (UL),
  - 8. Entertainment Services and Technology Association (ESTA)
  - 9. Entertainment Technicians Certification Program (ETCP)

1.6 DESCRIPTIONS AND REQUIREMENTS

- A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the Theatrical Rigging Systems. Refer to the Theatre Rigging Systems (TR Series) drawings for further information relating to this Section.
- B. Rigging and Drapery System: Drama Room Theatre
  - 1. Pipe Grid:
    - a. Shall be designed to accept the loads for the intended use.
    - b. Shall be suspended from overhead structure as described on the drawings.

- c. Primary support shall be from overhead; provide supplemental bridging strut as required for pipe-grid suspension hardware where structural constraints and obstructions may require its use.
  - d. Support shall include side-wall blocking for supplemental support and to prevent lateral movement of the completed assembly and the equipment affixed.
  - e. Components of the Theatrical Lighting System shall be integrated on the pipe grid.
- 2. Draperies and Curtain Tracks
  - a. Provide a series of black velour masking panels in the Drama Room to temporarily conceal the walls within the room as described and scheduled on the drawings.
  - b. Curtains shall be fabricated from professional grade inherently flame-retardant fabric fabricated for the intended use.
  - c. All drapery and associated hardware in the Drama Room shall mount on from the pipe grid as scheduled in the drawings.
    - 1) The masking legs shall be track mounted; operation will be by hand using walk-along track hardware.
  - d. Provide walk-along tracks to support a series of black velour masking panels conceal the walls within the room as described and scheduled on the drawings.
- C. General Requirements
  - 1. Each rigging component must include the quantity of wire rope lift lines, trim chains, compression sleeve fittings, pipe or truss batten sections, and all necessary hardware for a fully operable rigging system.
  - 2. Draperies shall be constructed of professional grade fabric intended for use as stage curtains. All draperies will be certified as flame retardant as a result of either their inherent characteristics or chemical treatment in accordance with the AHJ.

#### 1.7 RESPONSIBILITY AND RELATED WORK

- A. The drawings included with this specification convey general system concepts. The plans do not show complete and accurate building details. The Contractor is responsible for making the field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems. Coordinate the work with the General, Electrical and other related contractors as stated in Part 1.4, and the scheduled work of other trades.
- B. Verify the requirements and integrate components of the theatre lighting power and control system mounted to rigging hardware.
- C. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.
- D. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply systems in full working order. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.
- E. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner including any associated charges or fees.
- F. Execute all work in accordance with all Standard Authorities listed above, and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

#### 1.8 QUALITY ASSURANCE

- A. Contractor's Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
  - 1. No less than five years' experience with equipment and systems of the specified types under the same business name.
  - 2. Experience with at least five projects of comparable scale within the last two years.
  - 3. Employ only fully trained stage riggers and mechanics for the erection of the stage equipment.
  - 4. All theatrical rigging activity shall be supervised by an ETCP certified theatre rigger.

5. The stage riggers will be completely familiar with the type of equipment to be installed. A competent and knowledgeable Job Superintendent will be on the job at all times when work is in progress.
6. Maintain a fully staffed and equipped service facility.
7. Contractor shall attend pre-installation meetings to coordinate with other trades as required.

1.9 PRE-INSTALLATION SUBMITTALS:

- A. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the Contractor above 25% of the scheduled value of this work until all submittal information has been approved. Cost for the Owner's consultant to review secondary and re-submittals due to the Contractor failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Contractor. The cost shall be based on the hourly rates of the Architect and his consultants as published in their current professional fees schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost-plus ten percent (10%).
- B. Project Submittal Part 1:
  1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:
    - a. Section 1: A complete schedule of submittals.
    - b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.
- C. Project Submittal Part 2:
  1. Provide for approval no later than sixty (60) days after issuance of notice to proceed and in accordance with previously submitted submittal schedule.
    - a. Section 1: Complete list of products to be incorporated within the Work.
    - b. Section 2: Manufacturer's data sheets for each product. Provide original manufacturer's data sheets in order as they appear in the specification. These data sheets are submitted for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.
    - c. Section 3: Fabric Samples. Submit a sample book of each fabric specified, containing manufacturer's standard colors available in the quality of fabric specified for the Owner's selection and approval of color. More than one color may be selected. After selection, upon request, submit one square foot sample of each fabric in each color for final review.
    - d. Section 4: Submit Safety Data Sheets (SDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the SDS.
  2. Drawings:
    - a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drawing (CAD) system compatible with AutoCAD release 2013. Electronic files of theatrical rigging contract documents shall not be distributed for use in generating submittal documents with the exception of architectural backgrounds.
    - b. Drawings depicting attachment of equipment to structure or mechanical assemblies that support overhead loads must show the work has been reviewed and sealed by a structural engineer licensed to practice in the State of Texas.
    - c. Installation Drawings. Provide drawings showing special details depicting methods and means specific to each product and each product manufacturer's recommended installation methods and means. Provide assembly and attachment for each product. Drawings should be reviewed and sealed by a structural engineer licensed to practice in the State of Texas.
    - d. Schematic Drawings. Provide drawings detailing inter-component and intra-component, on Contractor assembled components or fabricated products.
    - e. Conduit and Electrical Drawings. If the system incorporates an electrical or electronic system of any type, provide floor plan drawings, including all walls, doors and rooms, showing exact power requirements and conduit routing for each system with the location of all junction boxes, terminations, etc.
    - f. Equipment Drawings. Provide equipment mounting and location details including necessary physical dimensions, clearances, load limits, etc.
    - g. Software diagrams showing the hierarchical structure of operator screens and functions with sample screen shots.
    - h. Floor plan and Section Drawings. Provide drawings showing the exact location of all installed equipment on floor plans and/or sections such as guide wires or tracks, loft blocks, battens, etc.
    - i. Custom Enclosures and Millwork Drawings. If custom enclosures or millwork is required, provide full fabrication detail drawings indicating size, material, finish and openings for equipment.

- j. Fabricated Plates, Panels, or Signage Drawings. If plates, panels, or signage is required, provide complete drawings depicting dimensioned locations of components, component types, engraving or printing information, plate material and color, and bill of material.
  - k. Labeling Drawing. Provide representative equipment labeling scheme of locking rail, loading rail, etc.
  - l. General Detail Drawings. Provide detail drawings depicting any unique installation methods specific to each product.
  - m. Any other pertinent data generated which is necessary to provide the Work.
- D. Submittal Format:
- 1. Electronic submission of submittals is required.
  - 2. Provide each submittal with a unique number and be numbered in consecutive order.
  - 3. Provide each submittal file with a label reflecting the project title and submittal number.
  - 4. Provide each submittal with a complete table of contents with the following information:
    - a. Project title and number.
    - b. Submittal number. In the case of a re-submittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
    - c. Date of submission.
    - d. Referenced addendum or change-order number as applicable.
    - e. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
    - f. Index Product Data sheets by manufacturer and model or part number.
  - 5. Separate major grouping with labeled tabs.
  - 6. Arrange product data list in alpha-numeric order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer's data sheets, arranged in the same order. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
  - 7. Drawings executed at an appropriate scale, not smaller than  $\frac{1}{8}" = 1'-0"$  for conduit/floor plans,  $\frac{1}{4}" = 1'-0"$  for equipment layouts, and  $\frac{1}{2}" = 1'-0"$  for mounting details and plate/panel details.
- E. Submittal Copies:
- 1. These requirements represent minimum project requirements; a project's general conditions may require additional copies for project distribution.
  - 2. Electronic submission of submittals is required.
  - 3. Submit (2) sets of product or sample finishes as required within this specification.
- F. Resubmission Requirements:
- 1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
  - 2. Indicate any changes that have been made other than those requested.
- G. Approval of Submittals: The submittal information will be reviewed by the general contractor, owner, Architects, engineers, and consultant. Each submittal package will be returned, stamped as follows:
- 1. "No Exceptions Taken" proceed with construction, all job site coordination will be at the direction of the general contractor.
  - 2. "Make Corrections Noted: No Resubmission Required" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.
  - 3. "Make Corrections Noted: Submit Corrected Copy" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.
  - 4. "REJECTED, Submit Specified Item" a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
  - 5. "REJECTED, Revise and Re-submit" submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
  - 6. "No Review Action Required" all information provided was for information or coordination purposes only. Review is not required.

#### 1.10 PROJECT RECORD MANUAL

- A. Submit three bound original sets (this is a minimum of two for the Owner and one for the Architect's consultant; additional copies may be required by the project's general conditions) after substantial completion and prior to final inspection.

- B. The Project Record Manual shall be segregated into three separate bindings as follows:
1. Operations Manual:
    - a. Product Data: Product actually incorporated within the Work:
      - 1) Manufacturer's data for each type of product conforming to the scheme above. The list shall include manufacturer's serial numbers.
      - 2) Owner/Instruction Manual for each product.
      - 3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
      - 4) Manufacturer's wiring diagram for each type of product actually incorporated.
      - 5) Separately bound list by manufacturer and model or part number of all products incorporated within the Work arranged in alphanumeric order.
    - b. Record drawings: Final rendition of that specified depicting what is actually incorporated within the Work. one (1) DVD-ROM containing all CAD generated drawings prepared in conjunction with this project. Drawing files to be in AutoCAD Release 2013 DWG format.
    - c. Test Reports: Recorded findings of testing specification of this specification.
    - d. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
      - 1) This procedure should describe the operation of all system capabilities.
      - 2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.
  2. Service & Maintenance Manual:
    - a. Provide an original copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
    - b. Manufacturer's maintenance and care instructions.
    - c. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
    - d. Replacement parts list of all minor equipment such as fuses, lamps, connectors, knobs, etc.
  3. Warranty Manual:
    - a. Manufacturer's warranty statements on each product.
    - b. Date of substantial completion and ending dates for warranties for each group of products.
    - c. Software registration and licenses.
- C. Include any other pertinent data generated during the Project or required for future service.
- D. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Ship product in its original container, to prevent damaging or entrance of foreign matter.
- B. Handling and shipping in accordance with manufacturer's recommendation.
- C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.
- D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

#### 1.12 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

#### 1.13 FINAL INSPECTION AND TESTING

- A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Architect and/or Architect's Consultant no earlier than two weeks after receipt of the written results.



- B. Provide a minimum of one (1) person for inspection and two (2) persons for testing familiar with aspects of the System to assist the Owner.
- C. The process of testing the System may necessitate moving and adjusting certain components such as counterweights on arbors, adjustment of drapery tracks, etc.
- D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.
- E. The following procedures will be performed on each System:
  - 1. Inspection of the methods and means employed to incorporate the System within the facility.
  - 2. Verification of proper operation, from controlling devices to controlled devices.
  - 3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each setting, and appropriately record these settings within the Record Documents.
  - 4. Other tests on equipment or systems deemed appropriate.
- F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner, at the standard rate in effect at that time.
- G. Contractor shall return to the jobsite six months after acceptance to inspect the rigging hardware and attachments, curtain tracks, curtains, and battens.

#### 1.14 WARRANTY

- A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost required to complete this warranty repair is the Contractor's responsibility.
- B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.
- C. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty-four hours.

#### 1.15 INSTRUCTION OF OWNER PERSONNEL

- A. After final completion, provide instruction to Owner and/or the Owner's designated personnel on the use, operation, maintenance and care of the System.
  - 1. Develop training course based on the use of the System and manufacturers' recommendation. Provide (2) hours of training. The training period shall be divided into two segments and shall be scheduled at least two weeks apart. All training shall be scheduled at the convenience of the owner and designated personnel.
  - 2. Submit an outline of the course with sample instructional aids for approval (30) days prior to scheduled instruction sessions.
  - 3. If a representative of the manufacturer is used in the instructional course, the Contractor must be present throughout the extent of the course and ensure that the representative abides by the requirements set forth in these specifications.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Model name and number for manufacturers included in this specification are listed to establish a standard of product quality.
- B. Substitution of specified products with other qualified manufacturers and products will be considered providing:
  - 1. Proper substitution procedures outline under Division 1 is adhered to.

2. A request for substitution of each specific product must be made in writing by a bidding Contractor not less than ten (10) business days prior to bid for written approval of the Architect.
  3. Sufficient data of the products is presented for prior approval including technical data, manufacturer's specifications, samples, and, if requested, results of independent testing laboratory tests.
  4. Written permission is obtained for the substitution from the Owner or Owner's Representative.
- C. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review. Include a list of previously installed projects using proposed equipment that are similar in nature to specified System.
- D. Provide product not specifically specified commensurate with the quality and standards established by the specified product.

## 2.2 GENERAL

- A. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.
- B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers' published specifications.

## 2.3 CONTACTS

- A. Listed below is contact information for Manufacturers of rigging components approved to provide equipment on this project:
- B. Automatic Devices Company
1. 2121 S. 12th Street, Allentown, PA. 18103
  2. Telephone: (610) 797-6000
  3. Approved to supply curtain track.
- C. J.R. Clancy
1. 7041 Interstate Island Road, Syracuse, NY 13209
  2. Telephone: (315) 451-3440
  3. Approved to supply stage rigging components, beam clamps, and associated hardware.
- D. Crosby Group, Inc.
1. P.O. Box 3128, Tulsa, Oklahoma 74101
  2. Telephone: (918) 834-4611
  3. Approved to supply rigging hardware including chain, cable clips, cable, and anchor shackles.
- E. H&H Specialties
1. P.O. Box 9327, South El Monte, Calif. 91733
  2. Telephone: (213) 283-3562
  3. Approved to supply stage rigging hardware and curtain tracks.
- F. K&M Fabrics
1. 2 Waco Street, Greenville, South Carolina 29611
  2. Telephone: (800) 845-1896
  3. Approved to supply curtain fabric.
- G. J.B. Martin
1. 445 rue St-Jean-sur-Richelieu, Quebec, Canada J3B 2M1
  2. Telephone: (514) 346-6853
  3. Approved to supply curtain fabric.
- H. Rose Brand Fabrics
1. 4 Emerson Lane, Secaucus, NJ 07094
  2. Telephone: (800) 223-1624
  3. Approved to supply curtain fabric.
- I. Rud Stage Rigging
1. 1300 Stoney Point Road SW, Cedar Rapids, Iowa 52408

2. Telephone: (800) 553-7993
  3. Approved to supply rigging hardware including chain and shackles.
- J. Texas Scenic Company
1. P.O. Box 680008, San Antonio, Texas 78268
  2. Telephone: (210) 684-0091
  3. Approved to supply rigging hardware and stage drapery.
- K. Ver Sales, Inc.
1. 2509 N. Naomi Street, Burbank, Ca. 91504
  2. Telephone: (818) 567-3000
  3. Approved to provide rigging hardware including chain and beam clamps.
- L. IWeiss
1. 815 Fairview Avenue Suite 10, Fairview, New Jersey, 07022
  2. Telephone: (201) 402-6500
  3. Approved to supply rigging hardware, stage drapery, stage rigging loft/head blocks, and curtain tracks.

## 2.4 RIGGING HARDWARE

- A. Batten Assembly
1. Pipe battens shall be constructed of new ASTM A53/A 1-1/2" nominal schedule 40 plain end steel pipe.
  2. Battens exceeding one standard pipe length will be joined using an internal splicing sleeve. Splices must provide the same overall capacity, deflection, and strength to the pipe battens as an un-spliced span. Threaded couplers are not permitted.
    - a. Splice sleeves shall be a minimum of 24" in length with a minimum of 12" extending into each pipe batten.
    - b. Sleeves will be machined to a diameter that will create a snug fit within the pipe battens.
    - c. Splicing sleeves will be fastened to the pipe batten with pins or 3/8" diameter bolts. Locate at least two fasteners on each side of splice joint; alternate direction of fasteners at right angles to one another across the diameter of the pipe.
  3. Any fasteners used on pipe battens must meet SAE grade 5, and be equipped with self-locking nuts.
  4. Cover the end of each batten with a yellow or white closed end, soft vinyl safety cap at least 4 inches in length. Cap shall display linesets maximum capacity, and lineset number.
- B. Batten Connections
1. Wire rope lift lines shall terminate directly to trim chains constructed of NACM chain certified by their manufacturer as suitable for the intended purpose.
  2. Chain shall be 1/4" diameter or larger, and of sufficient length to wrap one and one-half times around the pipe batten and return to the eye of the wire rope lift line.
  3. One chain end shall be terminated directly to the wire-rope eye, the other end secured with a forged screw pin anchor shackle rated for the intended purpose. The screw pin shall be moused or seized to ensure the pin will not release.
  4. Alternative designs for batten connection and trimming methods shall require approval as part of the submittal process.
  5. Where a pipe clamp may be required on a batten, a wrap-around type clamp shall be provided. This clamp shall be secured to the pipe using SAE 5 grade bolts, washers, and self-locking nuts.
  6. Acceptable products:
    - a. Clancy Alpha Chain
    - b. 7 mm (0.275") Grade 63 alloy chain
- C. Wire Rope Lift Lines
1. Provide lift lines and fittings appropriate for supporting the load requirements.
  2. For utility and drapery sets:
    - a. Lift lines shall be a minimum of 3/16" diameter 7 X 19 construction, galvanized aircraft cable with a breaking strength of 4200 lbs.
  3. For shell and stage electric sets:
    - a. Lift lines shall be a minimum of 1/4" diameter 7 X 19 construction, galvanized aircraft cable with a breaking strength of 7000 lbs.
  4. All wire rope must be new; damaged or deformed cable may not be used.
  5. Exposed ends of wire rope shall be cut cleanly, then seized.
- D. Wire Rope Termination

1. To connecting hardware, form eyes around an appropriately sized thimble using copper Nicopress® compression sleeves.
  2. To cable drums: terminate the wire rope on the inside of the lifting drum using a Nicopress® compression stop sleeve.
  3. Supply and install compression sleeves or clips in size and quantity per guidelines set forth in the Wire Rope User's Manual, by its manufacturer's specifications, and in accordance with industry guidelines.
- E. Rigging Accessories:
1. In certain instances special component parts, such as sheaves, idler blocks, extra lines, etc., will be necessary in order to provide a fully operable system. Where such requirements are necessary, furnish, install, and adjust these components comparable to the quality of the products listed in these specifications.
  2. Acceptable manufacturers:
    - a. H&H Specialties
    - b. JR Clancy
    - c. Crosby

## 2.5 FIXED PIPE GRID

- A. Provide pipe assemblies attached to structure as described in the drawings.
- B. Assemblies shall be constructed of new ASTM A53/A 1-½" nominal schedule 40 plain end steel pipe.
- C. Pipe Grid Configuration
1. Cross-over Clamps
  2. Intersecting pipes shall be joined with specialty hardware to clamp, join, and support pipe-grid segments. Clamps shall have a recommended working load of at least 1,500 lbs. U-bolts are not acceptable.
  3. Acceptable product:
    - a. JR Clancy Cross-Over Clamp
    - b. Approved equal.
- D. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.
- E. Suspension
1. The grid shall be rigidly hung from the overhead steel structures on centers at nominal 6 ft. x 6 ft. intervals, and not exceeding 8 feet in either direction. Suspension methods shall be either:
    - a. Pipe-hangers suitable to the intended load and SAE grade 5 threaded rod, or
    - b. ¼-inch, 7x19 galvanized utility cable ending in 6 inches x 3/8 inch (152.4 mm x 9.5 mm) forged turnbuckles attached to pipe clamps.

## 2.6 SUPPLEMENTAL STRUT HARDWARE

- A. Provide supplemental strut where required to bridge suspension points from disparate load-bearing structure, deck, or other assemblies.
- B. Provide mating hardware to suspension components above.
- C. Acceptable product:
1. Unistrut P-series channels selected and sized to the intended loads.
  2. Approved equal.

## 2.7 STAGE DRAPERIES TRACKS

- A. Walk-along Curtain Tracks
1. Provide materials and the labor to install the curtain tracks as located and configured on the drawings.
  2. Track shall be made of 6063-T5 aluminum, extruded into 2-½" I-beam with 1" wide top, intermediate and bottom flanges. Provide un-spliced lengths up to 24' in length.
  3. Track must mount to pipe battens on maximum 5'-0" centers with two-piece hangers formed from 11 gauge steel hangers.
  4. Provide single carriers, spaced 12" on center, constructed of (2) Delrin wheels fastened parallel to formed steel carrier body. Supply carriers with swivel hook for attachment of drapes. Install Nylatron

- wear strips at contact points to act as a bumper between each carrier to reduce friction. Provide neoprene bumpers between each carrier to reduce noise.
- 5. Provide walk along handles attached to the master carriers for operation of the curtain.
- 6. Provide end stops at each end of the track.
- 7. Ensure that all steel components are zinc plated for corrosion resistance.
- 8. Provide all track and associated hardware for the Drama Room factory coated BLACK
- 9. Acceptable products:
  - a. H&H Specialties series 300
  - b. ADC series 140

## 2.8 STAGE DRAPERY

- A. General Specification for Stage Drapery
  - 1. Provide and install all curtains as located and scheduled on the drawings.
  - 2. Field verify all dimensions prior to fabrication of draperies.
  - 3. Curtain fabric of professional grade fabric intended for stage use. If not inherently flame retardant, curtain fabric shall be chemically flame proofed at the mill using an immersion process. Flame proofing certificates for all fabrics used shall be furnished to the owner with the as-built drawings.
  - 4. Sew tags identifying manufacturer and size of panel at each end of webbing at top and at one corner at hem in each drape.
  - 5. Curtains must be constructed with vertical seams unless otherwise specified. The fabric grain shall run nap down and match in all panels. All panels must be un-spliced along their height.
  - 6. Construction
    - a. Black Poly webbing at 3-1/2" wide shall be double stitched to the top of the curtain with 1" of face fabric turned under the webbing.
    - b. Brass rustproof grommets shall be inserted
      - 1) at the extreme top corners
      - 2) in the pleat centers of curtains sewn with fullness, or
      - 3) on 12" centers for flat curtains.
    - c. Grommet holes for track mounted curtains shall be supplied with
      - 4) plated wire "S" hooks, or
      - 5) snap hooks, sewn-in at the spacing noted above.
    - d. Drapery hung directly from an auxiliary batten shall have a 24" long black cotton tie line fastened in each grommet hole.
    - e. The centerline of the drape shall be marked on the top webbing with "CL" and a white tie line added to the corresponding grommet.
    - f. Curtains sewn with fullness shall have box pleats spaced 12" on center.
    - g. Bottom hems shall be 4" wide. These shall be sewn with a separate canvas chain pocket inside so that the bottom of the canvas pocket rides 2 inches above bottom of the hem. Provide #8 plated jack chain in the pocket.
    - h. All traveling curtains shall be sewn with a minimum 24" of face fabric turned back at the leading edge. All other vertical hems shall be 2".
  - 7. Use mercerized cotton thread, minimum weight of #16, color to match drape fabric.
  - 8. Sew a 12" x 12" swatch of fabric near the lower offstage corner of each drapery for fire-resistance testing by the AHJ.
  - 9. Fabric colors shall be as scheduled. Submit color sample card with submittal documents. Make all effort to ensure that curtains of the same color are fabricated from fabrics of the same dye lot.
  - 10. Labeling
    - i. Sew labels onto the back (in most cases, upstage) side of the upper hem at both ends of each panel.
    - j. Curtain must have NFPA 701 flameproof certification tag sewn on the bottom of each curtain panel for Fire Inspection reference. This label should have permanent stitching around all four sides.
    - k. Labels shall clearly indicate
      - 1) date of manufacture
      - 2) cloth type
      - 3) manufacturer's name and address
      - 4) size (width and height using 3/4" minimum lettering
      - 5) owner's designated inventory number
  - 11. Acceptable product:
    - l. For nominal 20-21 ounce fabric:
      - 1) KM Fabrics Crescent inherently flameproof velour
      - 2) Rose Brand Encore inherently flameproof velour

## 2.9 COMPLETED SYSTEM

- A. General
  - 1. All installation of stage rigging equipment shall be completed utilizing new materials, free from flaws and rust, and in good working order. The jobsite shall be cleaned of all packing materials, lubricants, metal shaving, miscellaneous hardware, and components not used in the installation.
  - 2. All dimensions are to be field verified. Location and attachment of hardware and size of components shall be confirmed by the Contractor.
  - 3. All electrical power, outlets, related systems, and structural elements required to make the system fully functional are the responsibility of the contractor.
  - 4. If components and hardware are not specifically specified or called out, it is the responsibility of the contractor to provide those components in order to provide a fully operational theatre rigging system.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.
- B. Mount equipment and enclosures plumb and level.
- C. Permanently installed equipment to be firmly and safely held in place in accordance with specified safety factors and Federal and State codes and regulations.
- D. Work shall be completed within industry guidelines, including, ESTA, OSHA, NEC, ANSI, ASTM, AISC, NFPA, NFPA, plus any or all local, governmental, or other applicable codes.
- E. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the Contractor, in accordance with the accepted industry standards and guidelines in this section. In no way will the theatre rigging contractor be relieved of primary responsibility to provide a safe, fully functional system.
- F. The mechanical fabrication and workmanship will incorporate the best practices for good fit and finish. There will not be any burrs or sharp edges to cause a hazard, nor will there be any sharp corners accessible to personnel.
- G. All equipment will be installed based on the manufacturer's recommendations and for the use intended by the manufacturer.
- H. All shop and field welding will meet the qualifications of the AISC manual and will be without spatter or other evidence of poor practices.
- I. All finishes which are disturbed during shipping and installation will be touched up to match the original.
- J. Materials will conform to the following ASTM standard specifications:
  - 1. A-36 structural steel
  - 2. A-36 steel plates and bars
  - 3. A-47 malleable iron casting
  - 4. A-48 gray iron casting
  - 5. A-53 welded and seamless steel pipe
  - 6. A-120 black and hot dipped zinc-coated steel pipe
- K. In order to establish minimum standards of safety, the following factors will be used:
  - 1. cables and fittings provide a minimum 8:1 design factor
  - 2. cable bending ratio is 30 times the cable diameter
  - 3. nuts and bolts use minimum SAE grade 5 (ASTM rating A-449)
  - 4. thread pressure of
    - a. 500 lb. for cast iron
    - b. 1000 lb. for steel
    - c. 1500 lb. for Nylatron
  - 5. steel designed to 1/5 of yield
  - 6. bearings are rated for two times the required load operating at full speed for 2000 hours.

### 3.2 INSTALLATION OF STAGE DRAPES AND TRACKS

- A. Install all tracks and hardware according to manufacturer's recommendations.
- B. Stage draperies shall be installed near the end of the installation when chances of damage from other work are reduced. Stage area shall be broom clean with no further construction taking place prior to installation.
- C. After hanging stage draperies, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles will be allowed to fall out naturally.

### 3.3 LABELING OF EQUIPMENT

- A. Mark and label each batten with its set number, load/arbor capacity, stage centerline, and lift line locations with appropriate paint.
- B. Provide labels clearly indicating date of manufacture, cloth type, manufacturer's name and address, size (width and height using 3/4" minimum lettering), and Owner's designated inventory number (to be coordinated with Owner) will be sewn into the back (in most cases, upstage) side of the upper hem at both ends of each drape panel.

### 3.4 CONTRACTOR COMMISSIONING

- A. Prior to energizing or testing the System ensure the following:
  - 1. Products are installed in proper and safe manner according to manufacturer's instructions.
  - 2. Dusts, debris, solder splatter, etc. is removed.
  - 3. Labeling has been provided.
  - 4. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
  - 5. Products are neat, clean and unmarred and parts securely attached.
  - 6. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded. Job site shall be left broom clean.
- B. Provide two portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project.
  - 1. Include rechargeable batteries and re-charger along with "holster" for wearing on belt.
  - 2. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

END OF SECTION

SECTION 11 61 62

THEATRICAL LIGHTING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provision of the Theatrical Lighting Systems at the Drama Room.

1.2 RELATED DOCUMENTS

- A. Theatre Lighting Systems Drawings ("TL" Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.
- B. Section 11 61 33: Theatrical Rigging Systems and Stage Draperies, drawings, and documentation.
- C. Section 27 41 16: Integrated Audio-Video Systems and Equipment, drawings, and documentation.

1.3 SECTION INCLUDES

- A. Project instructions for the Contractor and System description details.
- B. System product descriptions.
- C. Project completion instructions for the Contractor.

1.4 RESPONSIBILITY AND RELATED WORK

- A. Coordination, supply, installation, shipping, storage, inspection, commissioning, testing, instruction and warranties of the Theatrical Lighting Systems.
- B. Plant, materials, equipment, transport and labor necessary to accomplish this and have a complete and fully functioning System.
- C. Also includes:
  - 1. Required licenses and permits including payment of charges and fees.
  - 2. Verification of dimensions and conditions at the job site.
  - 3. Provision of submissions.
  - 4. Installation in accordance with the Contract Documents, Manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
  - 5. Extension of electrical service, including ground, to equipment locations.
- D. The drawings included with this specification convey general system concepts. Where the plans do not show complete and accurate building details, the Contractor is responsible for making field measurements necessary to establish exact locations, relationships, and load capacities necessary for the installation of these systems.
- E. Coordinate the work with the related documents and the scheduled work of other trades.
- F. Conduit infrastructure system, including wire for AC Power and grounding for the Theatrical Lighting Systems, are provided as part of the Contract. Coordination between different disciplines is required to achieve a proper conduit system installation and power provisions for Theatrical Lighting Systems. All electrical installation shall be in accordance with Division 26.
- G. Supply accessories and minor equipment items needed for a complete and fully operational system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.



- H. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires the Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.
- I. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of their failure to have brought said discrepancies to the attention of the Architect.
- J. Execute all work in accordance with the NEC and all applicable State and Local codes, ordinances, and regulations.
- K. If a conflict develops between the Contract Documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

## 1.5 REFERENCES

- A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
  - 1. American National Standards Institute (ANSI)
  - 2. American Society of Testing and Materials (ASTM)
  - 3. Electronics Industries Association (EIA)
  - 4. Institute of Electrical and Electronic Engineers (IEEE)
  - 5. National Electrical Manufacturer's Association (NEMA)
  - 6. National Electrical Code (NEC)
  - 7. National Fire Protection Association (NFPA)
  - 8. Underwriters Laboratories (UL)
  - 9. Occupational Safety and Health Administration (OSHA)
  - 10. Entertainment Services and Technology Association (ESTA)
  - 11. United States Institute of Theater Technology (USITT)
  - 12. Illuminating Engineering Society (IES)

## 1.6 DEFINITIONS

- A. In addition to Division 1 definitions, the following list of terms as used in this Section shall be defined as:
  - 1. Owner – Cypress Fairbanks ISD
  - 2. Project – Cypress Creek HS 2024
  - 3. Consultant(s) – The Owner's Technical Representative(s) for this Section
  - 4. Architect – VLK Architects
  - 5. Contractor – The provider of all material, labor, and equipment necessary for the systems described in this Section
  - 6. Furnish/Supply – To purchase, procure, acquire, and deliver complete with all necessary accessories (CWANA)
  - 7. Install – To set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, item, or equipment supplied by the contractor.
  - 8. Provide – To furnish and install

## 1.7 DESCRIPTIONS AND REQUIREMENTS

- A. Lighting and Control System: Drama Room Theatre
  - 1. The Drama Room Theatre lighting system shall be comprised of a dedicated network-based control system communicating with the distributed power system and DMX devices to control all lighting elements within the facility.
  - 2. The lighting control console may be located variously within the Drama Room or Control Room. Console shall operate directly over the network.
  - 3. Motorized breaker panel (MBP) shall be located in the designated equipment room. All network and DMX interface control components for the Drama Room Theatre shall be located in an equipment rack provided as part of the 27 41 16 scope of work.

4. Remotely switched power shall be distributed throughout the theatre in flush wall-mounted and batten-mounted devices.
5. Network control shall be distributed throughout the Drama Room through a series of plug in ports for use with portable network node equipment and fixed network DMX nodes.
6. Architectural Lighting system shall be capable of supporting the same DMX values as the control console so that looks may be snapshotted then recalled through architectural station presets. This will include control of switched performance circuits and switched architectural lighting fixtures.
7. Architectural lighting control stations shall be located throughout the spaces in areas where architectural, work, and running lights will be accessed. Stations shall range from master touch screen, to pushbutton preset recall stations, to on/off switches. The system shall have the ability to "lock-out" stations in order to avoid nuisance switching during performance.
8. Ensure programming allows integration of occupancy and partition sensors and ability to override sensor for meetings and productions.
9. Install and configure step light fixtures to operate in conjunction with occupancy and partition sensors.
10. Provide theatrical lighting fixtures and required accessories. Installation is required under this base specification and shall include:
  - a. Hang and rough focus to the Owner's selected hanging plot.
  - b. Set-up, addressing and patch.
  - c. Verification of proper operation and associated training.

B. Focus

1. Contractor will hang, focus, and program lights to an Owner directed plot
2. The Owner may elect to generate their own plot. If not, the Consultant will provide this documentation.
3. If the Contractor finds any needed updates or changes before hang begins the Consultant or Owner will update the documents as needed.
4. The Contractor is responsible for tracking and updating all changes to the plot after it has been turned over for installation. These updates and changes may be provided to the Consultant as necessary. However, the Contractor is responsible for these updates and may be provided the plot in an editable format to make the updates.
5. The Consultant produced plot will provide the following information if applicable for each fixture:
  - a. Location
  - b. Unit number for that location
  - c. Type
  - d. Area/purpose
  - e. Mode
  - f. Fixture universe/address
6. As part of turnover documents, the Contractor will be required to ensure the following are provided:
  - a. An electronic version of the plot. Provided on a flash drive and preserved by the Contractor for at least the length of the warranty.
  - b. A B-sized version of the plot mounted to foamcore-like material.
  - c. All of the information listed above in number 5 and additionally all circuiting of fixtures.
7. As part of the final observation and testing (3.5) Consultant will verify the focus. The Contractor may elect to complete the focus before the final observation and make any changes noted by the Consultant at this time. If the Contractor elects to have the Consultant direct focus as part of final observation the following shall be provided:
  - a. At least (10) days notice
  - b. A board operator
  - c. At least (2) people to perform the focus
  - d. All required lifts and safety equipment
  - e. A focus target. Person or figure
  - f. Person or system to document any changes that arise as part of the focus

C. Console Programming

1. The Contractor shall create a starting show file for the project. The file will be loaded onto the console, provided to the Owner on a flash drive, and preserved by the Contractor for at least the length of the warranty. The Contractor will provide the starting show file to the Owner, if requested, following the requirements laid out in the warranty portion (1.14) of this specification and shall be considered a service call.

2. Owner may select to add, update, or change any of the information below. These changes may be directed before, during, or after initial training. The Contractor will make any requested changes provided any amount of training time is left in the project as outlined in the instruction of Owner personnel of this specification (3.6).
3. At the Owner's request program any fixture, color, or controllable attribute to provided faders.
4. Ensure all areas outlined in the console programming portion of this specification are covered as part of the instruction of Owner personnel of this specification (3.6).
5. Using the provided plot, the Contractor shall create the following console programming at a minimum, if applicable:
  - a. Patching
  - b. Patch all fixtures to channel numbers outlined in the plot.
6. Groups
  - a. (1) group for every area of the plot.
  - b. (1) group for every "row" of front lights
  - c. (1) group for every "row" of front lights from the left
  - d. (1) group for every "row" of front lights from the right
  - e. (1) group for every "row" of top lights
  - f. (1) group for every "row" of backlights
7. Palettes
  - a. Intensity
    - 1) Provide a 70% intensity for use in creating cues
  - b. Color
    - 1) Provide warm (R02) and cool (R3202 or R60) for ease of selection.
    - 2) Provide a red (R27), green (R90), and blue (R80) for use on cyclorama fixtures
    - 3) A warm white. Roughly 3200K
8. Interactive Control Display (Magic Sheet)
  - a. Provide an interactive control display to aid in programming and console use
  - b. The interactive display shall utilize a combination of standard and user-defined symbols to generate a fixture layout which copies the light plot as closely as reasonably possible.
  - c. Selectable fixtures will, at a minimum, indicate the following parameters or palettes and their current states:
    - 1) Fixture type
    - 2) Channel
    - 3) Intensity
    - 4) Color
  - d. Provide controls for all groups as described above

## 1.8 QUALITY ASSURANCE

- A. Contractor's Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
  1. No less than five (5) years of experience with equipment and systems of the specified types.
  2. Experience with at least five (5) comparable scale projects within the last two (2) years.
  3. Engage the services of a Manufacturer certified technician.
  4. Be a franchised dealer and service facility for the manufacturer's products furnished.
  5. Maintain a fully staffed and equipped service facility.
  6. At the request of the Architect, demonstrate that:
    - a. Adequate plant and equipment are available to complete the work.
    - b. Adequate staff with commensurate technical experience is available.
- B. Manufacturer's Qualifications:
  1. No less than five (5) years continuous experience in the production of specified type of product.
  2. Production shall meet applicable NEMA standards.

## 1.9 SUBMITTALS:

- A. Provide submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures section unless otherwise indicated.
- B. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the Contractor above 25% of the scheduled value of this work

until all submittal information has been approved. Cost for the Owner's consultant to review secondary and re-submittals due to the Contractor's failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Contractor. The cost shall be based on the hourly rates of the Architect and Consultants as published in their current professional fees schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus ten percent (10%).

- C. Submittals must be original work produced by the firm responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim shall be made for delay, undue burden, or additional costs for the effort to produce shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.
- D. Project Submittal Part 1:
  - 1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:
    - a. Section 1: A complete schedule of submittals.
    - b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.
- E. Project Submittal Part 2:
  - 1. Provide for approval no later than sixty (60) days after issuance of Notice to Proceed and in accordance with previously submitted submittal schedule.
  - 2. Products:
    - a. Section 1: Complete list of products to be incorporated within the Work (Bill of Materials).
    - b. Section 2: Manufacturer's data sheets for each product.
      - 1) Provide original manufacturer's data sheets in order as they appear in the specification.
      - 2) Data sheets are required for each product in sufficient detail to evaluate product suitability for incorporation within the Work.
      - 3) Product literature shall include documentation of UL Listing or approved recognition by a Nationally Recognized Testing Laboratory (NRTL).
    - c. Section 3: Provide Architect and/or Architect's Consultant with samples of wall plate materials and colors as specified in this section.
    - d. Section 4: Submit Safety Data Sheets (SDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the SDS.
  - 3. Drawings:
    - a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system. Electronic files of theatrical lighting contract documents shall not be distributed for use in generating submittal documents with the exception of Architectural backgrounds.
    - b. Schematic Drawings.
      - 1) Provide drawings detailing cabling-riser intent.
      - 2) Give each component a unique designator and use this designator consistently throughout the project.
      - 3) Include inter- and intra-component connections and cabling diagram depicting cable types, designators, and color codes.
    - c. Installation Drawings.
      - 1) Provide drawings showing the coordinated locations of all installed equipment. Drawings shall include floorplans and other views as necessary to fully describe the intended finished conditions.
      - 2) Provide Conduit and Electrical Drawings indicating:
        - a) Conduit sizing/routing for each system component,
        - b) Locations where power is required along with the location of all junction boxes.
      - 3) Detail Drawings: Provide drawings showing special details depicting methods and means specific to each product, assembly and each product Manufacturer's recommended installation methods and means.
    - d. Equipment Drawings:
      - 1) Rack and Panel Elevations: Provide a front elevation of all racks and/or panels.
      - 2) Rack and Panel Assembly Details: Provide drawings showing location of equipment in racks with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.

- 3) Custom Enclosures and Millwork Drawings: Provide full fabrication detail drawings indicating size, material, finish, and openings for equipment.
  - 4) Fabricated Plates and Panels Drawings: Provide complete drawings of custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
  - e. Schedule Drawings: Provide load schedules noting source and destination of wiring and associated connected load.
  - f. Labeling Drawing: Provide representative equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and descriptor and designator schedule.
  - g. General Detail Drawings: Provide detail drawings depicting any unique installation methods specific to each product.
  - h. Control Screen Templates: Provide layout drawings and/or screenshots for master house lighting stations and similar electronic control surfaces.
  4. Any other pertinent data generated which is necessary to provide the Work.
- F. Submittal Format:
1. Electronic (PDF) submittal documents are required for review.
  2. Provide each submittal with a unique number and each shall be numbered in consecutive order.
  3. Submittals shall not be issued with other disciplines.
  4. Provide each submittal with a complete table of contents with the following information:
    - a. Project Name
    - b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and shall be numbered in consecutive order.
    - c. Date of submission.
    - d. Referenced specification Section, Part, Article, Paragraph, and page number or drawing reference as applicable.
  5. Follow list by Manufacturer's data sheets, arranged as in Part 2 of this specification. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
  6. Drawings executed at an appropriate scale, but not smaller than  $1/8" = 1'-0"$ .
- G. Resubmission Requirements:
1. Make any requested corrections or change in submittals required. Resubmit for review as directed.
  2. Indicate any changes that have been made other than those requested.
  3. Approval of Submittals: Each submittal package will be returned with one of the following stamps:
    - a. "No Exceptions Taken" proceed with construction; all job site coordination will be at the direction of the General Contractor.
    - b. "Make Corrections Noted: No Resubmission Required" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.
    - c. "Make Corrections Noted: Submit Only Corrected Pages/Items" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.
    - d. "REJECTED, Submit Specified Item" a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
    - e. "REJECTED, Revise and Re-submit" submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
    - f. "No Review Action Required" all information provided was for information or coordination purposes only. Review is not required.
  4. Any of the above stamps may also carry a "PARTIAL" stamp. This indicates that required information noted in the section above was not provided. Omitted items may be noted as part of the reviewed submittal, but it is the Contractor's responsibility to verify all required submittal documentation.

#### 1.10 PROJECT RECORD MANUAL

- A. Provide electronic copies of the project record documents or as required per the General Conditions of the Project.
- B. The Project Record Manual shall be segregated into three separate bindings as follows:
  1. As-Built Record Documents:
    - a. Product Data:

- 1) List of all products incorporated in the Project inclusive of all substitutions, field changes, or revisions. The list shall include Manufacturer's serial numbers.
- 2) Manufacturer's data for each type of product conforming to the scheme above.
- 3) Organize and bind the above in specification order.
- b. Record drawings: Final rendition of project drawings enumerated in the Submittal section above. Provide editable computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system, in both a DWG and PDF file format.
- c. Test Reports: Record findings of systems testing described in Part 3 below.
2. Operations Manual
  - a. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
    - 1) This procedure should describe the operation of all system capabilities.
    - 2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.
3. Service & Maintenance Manual:
  - a. Provide an original copy of the service manual on every piece of equipment for which the Manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
  - b. Manufacturer's maintenance and care instructions.
  - c. Maintenance Instructions: include maintenance phone number(s) and hours, maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
4. Warranty Manual:
  - a. Manufacturer's warranty statements on each product.
  - b. Date of substantial completion and ending dates for warranties for each group of products.
  - c. Software registration and licenses.
5. Include any other pertinent data generated during the Project or required for future service.
6. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Products shall ship and be stored in their original container to prevent damaging or entrance of foreign matter.
- B. Provide protective covering during construction to prevent damaging or entrance of foreign matter.
- C. Replace, at no expense to Owner, product damaged during storage, handling, or the course of construction.

#### 1.12 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

#### 1.13 FINAL TESTING AND OBSERVATION

- A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Consultant.
- B. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

#### 1.14 WARRANTY

- A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost associated with this warranty repair is the responsibility of the Contractor.
- B. This warranty is in addition to any specific warranties issued by Manufacturers for greater periods of time.
- C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.
- D. During the warranty period, the Manufacturer shall provide a toll-free 24-hour-per-day number for telephone technical support and service request. If callback is required, calls shall be answered within thirty (30) minutes.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed to establish a standard of product function, performance, and quality. Products or manufacturers listed herein are listed in no particular order or preference.
- B. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure. Substitution of any equipment within this specification shall require review and approval by WJHW.
- C. Substitution of specified products with other qualified manufacturers and products will be considered providing:
- D. A request for substitution of each specific product must be made in writing by a bidding Contractor not less than ten (10) business days prior to bid for written approval of the Architect.
- E. Sufficient data of the products is presented for prior approval including technical data, manufacturer's specifications, samples, and, if requested, results of independent testing laboratory tests.
- F. Written permission is obtained for the substitution from the Owner or Owner's Representative.
- G. Providing product not specifically specified without prior written approval by the Owner, Architect, and/or Architect's Consultant shall not be accepted.

### 2.2 GENERAL

- A. Products shall be new, free from defects and listed by an NRTL when an applicable NRTL Standard exists. Provide product of a given type from one manufacturer.
- B. Provide product of a given type from one manufacturer.
- C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers' published specifications.

### 2.3 CABLING AND ACCESSORIES

- A. All cable shall be compliant with NEC and NRTL listed. Any NRTL listing must be available at the time of bid.
- B. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g., CMR, CMP, etc.)

- C. Cable shall carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
- D. Where cables are routed through cable tray, provide tray rated cable of equal specification.
- E. Where cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.
- F. Shielded cables located in raceways shall have aluminum foil shield with drain wire.
- G. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from Carol, Liberty, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables.
- H. DMX512 (E-DMX) distribution cable:
  - 1. Provide 24 AWG four twisted pair data cable.
  - 2. Pair Color Code Chart:
    - a. 1 – White/Blue Stripe and Blue
    - b. 2 – White/Orange Stripe and Orange
    - c. 3 – White/Green Stripe and Green
    - d. 4 – White/Brown Stripe and Brown
  - 3. Insulation: Polyolefin
  - 4. Inner/Outer Jacket Material: PVC – Polyvinyl Chloride
  - 5. Nominal Impedance: 100 ohms.
  - 6. Nominal Velocity of Prop.: 72%
  - 7. Capacitance between conductors: 15.0 pF/ft.
  - 8. Acceptable product:
    - a. Belden 1583A (Category 5E).
- I. DMX512 (E-DMX) distribution cable – Stage Electric Drops:
  - 1. Provide extra rugged, flexible control cable (Ethernet) for connection of NET outlets on grid to electric batten distribution.
  - 2. Cable to be four-pair, double shielded, low-capacitance.
  - 3. Conductors: 26 AWG tinned, annealed copper stranded 7 x 0.16.
  - 4. Connector: Provide with EtherCon connector by Neutrik®.
  - 5. Assembly: pairs cabled with Kevlar strength member.
  - 6. Shield: (inner) aluminum/Mylar, 100% coverage (outer) tinned copper braid, 80% coverage.
  - 7. Conductivity: 15ohms per 100 meters @ 20C.
  - 8. Impedance: 100 ± 15 ohms 1-100MHz.
  - 9. Acceptable product:
    - a. TMB & Associates ProPlex or equivalent.
- J. DMX512 Backup Control Signal Distribution Cable:
  - 1. Provide 24 AWG two twisted pair cable.
  - 2. Insulation: Foam polyethylene.
  - 3. Shield: aluminum foil/polyester tape.
  - 4. Capacitance between conductors: 12.5 pF/ft.
  - 5. Acceptable product:
    - a. Belden 9729
- K. Architectural Lighting DMX Cable:
  - 1. Provide 24 AWG two twisted pair cable.
  - 2. Insulation: Foam polyethylene.
  - 3. Shield: aluminum foil/polyester tape.
  - 4. Capacitance between conductors: 12.5 pF/ft.
  - 5. Acceptable product:
    - a. Belden 9842
- L. Preset Station Signal Distribution Cable:
  - 1. Provide 16 AWG single twisted pair cable.
  - 2. Insulation: PVC-polyvinyl chloride.
  - 3. Shield: unshielded.



4. Capacitance between conductors: 33 pF/ft.
  5. Acceptable product:
    - a. Belden 8471
- M. Multi-Conductor SO Type Cable:
1. Provide multi-conductor cable with black neoprene jacket.
  2. Conductivity: not less than 98%.
  3. Conductor: soft drawn annealed stranded copper.
  4. Minimum Conductor Temperature: 90° C.
  5. Size: No. 12 AWG minimum.
  6. No. of Conductors: As required by circuits shown.
  7. Acceptable product:
    - a. Cole Wire & Cable
    - b. Carol
    - c. Rome

## 2.4 POWER DISTRIBUTION

- A. Wall-Mounted Motorized Breaker Panels (MBP)
1. General
    - a. Breaker Panels shall be UL Listed,
    - b. Breaker Panels shall consist of a main enclosure with 12, 24, or 48 pole breaker subpanels, integral control electronics for low voltage terminations and provision for accessory cards
    - c. The panel shall be constructed of 16-gauge galvanized steel. All panel components shall be properly treated or finished in fine-textured, scratch resistant paint
    - d. The unit shall provide interior cover over the control electronics and accessory cards to allow access only to class 2 wiring and prevent direct access to class 1 line voltage components
    - e. Circuits as described in schedule
    - f. Breakers shall provide manual switching control while power is unavailable
  2. Each panel shall have a keypad and LCD display for rack configuration, backup, and fault indication.
  3. Panels shall employ USITT DMX-512 control format.
  4. An Ethernet connection shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit via an internal Web UI or central monitoring interface
  5. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems.
  6. Electrical
    - a. Breaker Panels shall be available to support power input from:
      - 1) 120/208V three phase 4-wire plus ground
    - b. Breaker panels shall support main circuit breaker options:
    - c. As required for functional system based on existing electrical service or Division 26 documents
  7. Breaker Panel Accessories
    - a. A low voltage 0-10V dimming option shall provide up to 24 0-10v control outputs that are linked to relay circuits within the panel. Each output shall support up to 400mA of current sink per output
    - b. A contact input option shall provide 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained, or momentary toggle
  8. Provide with main disconnect breaker option.
  9. Quantity: As shown in drawings
  10. Acceptable Product
    - a. Lyntec - LCP Series Lighting Control Panelboards
    - b. Vari-lite – Contact Relay Panel
    - c. Electronic Theatre Controls – Sensor IQ Panel
- B. Distribution Wiring Devices
1. General
    - a. All power distribution devices overall assembly shall be listed by a nationally recognized test lab.
    - b. All dimmed circuit connectors shall be 20A grounded stage pin type. All switched circuits connectors shall be 20A twistlock type. All connector types provided shall be of a single manufacture.
    - c. All pigtails shall be three-wire type "SOW" rubber jackets cable. All pigtails to be provided with proper strain relief.

- d. All power distribution devices shall be fabricated from minimum 18-gauge galvanized steel and finished in black fine-textured powder coat paint unless noted otherwise. Boxes shall be free from burrs, sharp corner, and overhanging edges.
  - e. Circuits for Raceways and Plugging Boxes shall be labelled with 2" yellow on black Brady numbers. Numbers shall be located so that they are not obscured by cabling. Circuits shall be assigned and labelled per schedules on drawings
  - f. Circuits for Wall Boxes and Floor Pockets shall be labelled with 1" yellow on black Brady numbers. Numbers shall be located so that they are not obscured by cabling. Circuits shall be assigned and labelled per schedules on drawings. As a rule, circuits shall number Stage Left to Stage Right, Down stage to Upstage.
  - g. All power distribution devices shall be provided with appropriate mounting hardware.
  - h. All multi-conductor cable is to be provided with Kellems-type strain relief grips at each end of the cables with intermediate strain relief as required.
  - i. Provide connector strips, gridiron junction boxes (GIJB), and associated hardware for over the stage lighting. Coordinate connector strip lengths for electrics with the theatrical rigging equipment. Provide all multi-conductor cables allowing the devices to fly to a low trim as indicated on the TR sheets. The cable is to be provided with necessary cable strain relief grips as part of the cable management system. Provide rugged network control cables to parallel the multi-conductor cable runs. Verify all electrical circuits and label all circuit numbers as specified.
2. Wall Mounted Boxes (WB)
- a. Provide a wall plug-box designed for recessed mounting.
  - b. Construction: code gauge steel.
  - c. Connectors: female 20 Ampere twistlock-type connectors surface mounted in the plug-box.
  - d. Circuits: number of circuits as specified on drawings.
  - e. Labeling: circuits are labeled with yellow letters on black background.
  - f. Overall assembly UL listed.
  - g. Quantity: As shown in drawings.
  - h. Acceptable product:
    - i. Altman 450 series
    - j. ETC 9200 series
    - k. SSRC RM series
3. Pipe Mounted Boxes (PB)
- a. Provide a plug box designed for pipe mounting.
  - b. Construction: code gauge steel.
  - c. Pigtails: SO type cable. Provide lengths as shown on drawings.
  - d. Connectors: female 20A twistlock connectors on the end of each of the pigtails and flush mounted 20A parallel blade receptacles for convenience circuits.
  - e. Circuits: number of circuits as specified on drawings.
  - f. Labeling: circuits are labeled with yellow letters on black background.
  - g. Overall assembly UL listed.
  - h. Quantity: As shown in drawings.
  - i. Acceptable product:
    - 1) Altman 450 series
    - 2) ETC 9300 series
    - 3) SSRC PM series

## 2.5 CONTROL EQUIPMENT

- A. Control Distribution Panel (CDP)
- 1. Provide wall-mounted unit to house components within as described on the drawings
  - 2. Provide a low profile, wall mounted NEMA 1 enclosure constructed of 16 gauge steel.
  - 3. Enclosure shall have a hinged, locking door of same construction.
  - 4. Enclosure shall be properly vented to maintain acceptable equipment operating temperature.
  - 5. Enclosure shall be sized to house all necessary components for the lighting control network.
  - 6. Provide an integrated rack rail system to accommodate adjustable and easy mounting of network components.
  - 7. Rails shall be constructed of 11 gauge steel with tapped 10-32 mounting holes in universal EIA spacing.
  - 8. Enclosure shall have cable management features including pass-through on back pan, sufficient cable tie points and knockouts on top, bottom and sides.
  - 9. Enclosure shall have a powder coat finish. Color per Manufacturer's standard.
  - 10. Enclosure shall be UL listed.
  - 11. Quantity and details: As shown on drawings

12. Acceptable product:
  - a. ETC DIN14 or DIN28 Enclosure
  - b. Pathway 1100 Series Enclosures
  - c. Vari-lite Vision.NET DIN Rail Enclosure
- B. UPS Backup Power / Surge Protection
  1. Provide a DIN rail mountable UPS backup to support equipment located in the control distribution panel (provide with one (1) spare battery).
  2. Output Power Capacity: 500VA/120V
  3. Input 120V/ Output 120V
  4. Interface Port: DB-9 RS-232
  5. Extended runtime model
  6. Rack Height: 2 Units
  7. Filtering: Full time multi-pole noise - filtering: 0.3% IEEE surge let-through: zero clamping response time: meets UL 1449
  8. The UPS shall be provided by the lighting control system manufacturer.
  9. Quantity: As shown in drawings.
  10. Acceptable product:
    - a. APC
    - b. Tripp Lite
    - c. Middle Atlantic
- C. Control Components
  1. Ethernet Switches (ESW)
    - a. Provide business grade Gigabit PoE+, Layer 2 managed Ethernet switches in the CDR as shown in the TL series documents.
    - b. Switch shall include 24 POE+ ports meeting IEEE802.3at standard
    - c. Switch shall include port routing via separate VLAN subnets
    - d. Switch shall be equipped with LED indicators for power status, port status, bandwidth utilization, collision detection and speed indication.
    - e. Switch shall have a built-in web-based management interface to provide easy to use management through a standard browser. Provide with all required software management tools.
    - f. Provide DIN rail mount kit and required hardware and cables for stacking.
    - g. Each network location shall have a dedicated input point on the network switch. Dedicated input points shall be clearly labeled to identify connected network device at the patch panel. Patching shall not be required.
    - h. Ethernet switch shall be tested and approved by Lighting Control System Manufacturer for compatibility with all connected devices.
    - i. Quantity: As required by design
  2. Network Node/Gateway
    - a. Provide DIN rail-mounted DMX Ethernet node/Gateway to generate DMX to devices located at theatrical and house architectural lighting positions
    - b. Nodes shall have (4) screw terminal or 5-pin DMX connectors for a total of 4 DMX universes for distribution over the Ethernet system.
    - c. DMX Node shall have LEDs for indication of power, network activity, and DMX port configuration.
    - d. Each input shall route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
    - e. Quantity: As required by design.
    - f. Acceptable product:
      - 1) Pathway rack or DIN rail mounted gateway
      - 2) Vari-lite rack or DIN rail mounted gateway
      - 3) ETC rack or DIN rail mounted gateway
- D. Plates and Devices
  1. Network Receptacle Station/Gateway (NET)
    - a. Provide a remote plug-in station for connection of control console and portable DMX Gateways at control booth and other locations as noted in the drawings.
    - b. Station shall be provided with a Neutrik RJ45 jack. Each jack shall be rated for use in harsh commercial conditions.
    - c. Station will contain the following components:
      - 1) RJ 45 jack with punch down block, provide Neutrik EtherCon type receptacle as indicated on drawings.

- 2) Station faceplates shall be .80" aluminum, finished in fine texture, scratch-resistant black powder coat.
  - 3) Station back box will be a minimum of 2.5 inches.
  - 4) Station shall have silk screened graphics white in color.
  - 5) Provide a Lamacoid label that de-notes, using an alpha-numeric labeling convention, the switch location and network port number.
- d. These network connections shall also be configured with a back box and mounting hardware for mounting on the FOH lighting galleries or backstage.
- e. Each Network jack will route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
- f. No daisy chaining between jacks or splicing of Category 5e and above cable is allowed.
- g. Quantity: As shown in drawings.
- h. Acceptable product:
  - 1) Pathway Network station
  - 2) Vari-lite station
  - 3) SSRC station
  - 4) ETC Network station
2. DMX512 Distribution (DMX):
  - a. Provide DMX512 distribution for connection to wiring devices in the Classroom and Auditorium.
  - b. Modules shall provide one optically isolated DMX512 signal output capable of driving thirty-two (32) receiving devices on a single DMX line.
  - c. Provide a wall plugging box designed for surface mounting.
  - d. Construction: code gauge steel.
  - e. Connectors: Neutrik 5 conductor XLR, flush mounted.
  - f. Circuits: located as shown on the drawings.
  - g. Labeling: labeled with yellow letters on black background.
  - h. Quantity: As shown in drawings.
  - i. Acceptable product:
    - 1) Pathway Connectivity station
    - 2) Vari-lite station
    - 3) SSRC station
    - 4) ETC station
3. Control Receptacle Station (CR#)
  - a. Provide a flush-mounted control station for connection of the control console over network.
    - 1) Provide with DMX receptacles as described on the drawings.
  - b. Station will contain receptacle components as described on the drawings.
  - c. Station faceplates shall be .80" aluminum, finished in fine texture, scratch resistant black powder coat.
  - d. Station Back box will be a minimum of 2.5 inches deep
  - e. Station shall have white, silk screened graphics
  - f. Provide a Lamacoid label for network jacks that denotes, using alpha-numeric labelling convention, the switch location and network port number.
  - g. Each network jack shall route directly to the Ethernet switch without the need for patching.
  - h. No daisy-chaining between jacks or splicing on network cabling is allowed.
  - i. Quantity: As shown in drawings.
  - j. Acceptable product:
    - 1) Pathway Connectivity station
    - 2) Vari-lite station
    - 3) SSRC station
    - 4) ETC station

## 2.6 CONTROL CONSOLE AND ACCESSORIES

### A. Control Console

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems.
2. The system shall also be able to control third party ACN devices directly. The system shall provide control of 1,024 or 6,144 outputs on a maximum of 32,768 control channels.
3. A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.

4. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.
5. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.
6. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of other non-intensity parameters. Non-intensity parameters shall be controllable via the encoders or keypad controls, without need of an external pointing device.
7. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.
8. The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.
9. A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys shall be labeled via an adjacent LCD display that shows their current functions at all times. Systems using softkeys with no LCD display shall not be acceptable.
10. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.
11. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.
12. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.
13. Accessories:
  - a. Provide (2) external touchscreens high resolution DVI monitors that will display system information, including playback status, live output and blind values for all record targets.
  - b. Provide (1) fully-functioning, detachable alphanumeric keyboard. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.
  - c. Provide with dust cover
  - d. Provide with USB mouse
  - e. Provide with 25' network control cable
  - f. Provide (1) Little with 3-pin XLR connector
  - g. Provide (1) USB jump drive, minimum 8gb
14. Quantity: (1)
15. Acceptable product:
  - a. Electronic Theater Controls Element 2 with 1,024 channels of control

## 2.7 ARCHITECTURAL CONTROL SYSTEM

- A. Processing – Provide either a rack mounted control processor located in the control distribution rack or provide distributed processing at each control station.
  1. The processing rack shall receive output data from a lighting control console and/or architectural control stations, process the information it receives and distribute the information to DMX-controlled panels and devices.
  2. Processing Racks shall be designed to support the following wire terminations:
    - a. AC (single phase)
    - b. Echelon link power
    - c. 24Vdc
    - d. DMX512 In
    - e. DMX512 Out
    - f. RS232 Serial In/Out
    - g. Net3 Unshielded Twisted Pair (UTP) or ST fiber optic
  3. Coordinate integration of audio-visual system with contractor and program system as directed by the End User.
- B. Configuration – Configure architectural control system screens in conjunction with User prior to commissioning. Base configuration shall accommodate the following basic layouts:
  - a. Main Navigation
  - b. User configurable named presets (2 pages to be programmed at training)
  - c. House light individual control
  - d. House light presets

- e. Blue light individual control
  - f. Blue light presets
- C. Stations - General
- 1. Master stations shall be located in the control booth, backstage and as noted on the contract documents.
  - 2. Provide preset stations as described below and shown in drawings.
  - 3. All audience exposed switches shall be provided with locking covers and shall be painted a custom color as determined by the architect.
- D. Acceptable product:
- 1. Electronic Theatre Controls Paradigm System with ERn
  - 2. Strand Lighting Vision.net
  - 3. Interactive Technologies CueServer3 Pro
- E. House Lighting Fixture Control
- 1. Contractor shall be responsible for installation and termination of DMX and/or 0-10v to all architectural house light fixtures. It is the Contractor's responsibility to verify operation on ground before fixtures are permanently installed. Any required DMX and/or 0-10v controlled interface shall be provided by the Contractor including equipment parts, labor and installation of equipment.
- F. Control Stations/Receptacles
- 1. House Light Master Station (HLM)
    - a. Provide full color 7" LCD touchscreen master station.
    - b. Station shall be wall mounted or rack mounted as shown on drawings
    - c. Station finish shall be black in technical areas and color selected by Architect for public spaces.
    - d. Station shall be configurable with system software via USB, serial data and Network interface
    - e. Station shall have the ability to store multiple configurations with the User being able to select which is active.
    - f. Station shall accommodate individual zone control, preset record and selection function.
    - g. Station shall be able to lock out preset stations located in the facility.
    - h. Master station shall have local control for each work light, house lights, running lights and other settings as required by the Owner.
    - i. Quantity: As shown on the drawings.
    - j. Acceptable product:
      - 1) Electronic Theatre Controls – Unison Paradigm touchscreen station
      - 2) Vari-lite – Vision.net touchscreen station
      - 3) Interactive Technologies – CueServer3 Pro Insite touchscreen station
- G. Environmental and Energy Controls
- 1. Ceiling Mount Occupancy/ Vacancy Sensors (OVS)
    - a. Provide a sensor capable of occupancy or vacancy detection based on software configuration
    - b. Sensors shall provide configuration buttons for:
      - 1) Linking of station to lighting control system
      - 2) Enabling walk-test mode
    - c. Sensors shall include customizable masks to block unwanted areas from view
    - d. Sensors shall include an adjustable mounting base that supports the following mounting options:
      - 1) Mounting to any standard ceiling box
      - 2) Mounting to any standard junction box
      - 3) Mounting to single gang RACO box
      - 4) Mounting to drywall or soft ceiling tiles using an included wire form adapter
    - e. Sensors shall utilize LED illumination for status feedback of motion detection and for use during programming
    - f. Sensors shall meet ASHRE 90.1, CA Title 24 and NYC local law 48
    - g. Provide 360-degree coverage range and include configurable masking.
    - h. Sensors functions shall support:
      - 1) Configurable time delay and sensitivity
      - 2) Independent programming of any system function as occupied and unoccupied events
      - 3) Overrides
    - i. Quantity: As shown on the drawings.
    - j. Acceptable product(s):
      - 1) ETC Unison Echo Dual Tech Occupancy Sensor

- 2) Vari-lite Vision.net Ceiling Mount Occupancy Sensor
  - 3) Or approved equal
2. Partition Sensor Set (PSS)
  - a. Provide partition sensors for automatic detection of movable wall positions in divisible spaces.
  - b. Type: Infrared (IR) beam sensor system consisting of (2) parts:
    - 1) Emitter
    - 2) Sensor
  - c. Power: 24DC power input
  - d. Acceptable product:
    - 1) ETC Automation Direct Sensor/Emitter

## 2.8 MISCELLANEOUS

- A. Type 'WS' Running Lights
  1. Provide any and all required drivers to interface with the theatrical lighting control system.
  2. Housing: Black unless noted by Architect.
  3. Coordinate installation with Electrical.
  4. Overall assembly is to be UL listed.
  5. Installation: Field verify dimensions before installation. Coordinate with Electrical contractor and Theater Consultant. Lighting calculation and exact locations to be reviewed by Electrical Engineer and Theater Consultant before final installation.
  6. Provide with necessary leader cables, power supplies, transformers, and mounting hardware, etc.
  7. Provide time (assume two [2] hours minimum) for final DMX control programming with Theater Consultant or Architect at closeout of project.
  8. Quantity: As shown on the drawings
  9. Approved Product:
    - a. ETC BlueBeam – BSDBF with BSEL Eyelid accessory
    - b. Or approved equal

## 2.9 PORTABLE LIGHTING FIXTURES AND ACCESSORIES

- A. Provide and integrate the following equipment into the project.
  1. Theatrical Lighting Fixtures
    - a. The portable lighting fixtures shall connect and be controlled by the new theatrical lighting control system.
    - b. All fixtures shall be listed by UL or an OSHA approved NRTL.
    - c. Fixtures shall be constructed of rugged die cast aluminum with high impact knobs and handles unless otherwise noted.
    - d. Fixtures shall be provided with a black finish unless otherwise noted.
    - e. Fixtures shall have a rugged steel yoke with a positive locking clutch which will allow for a 300° body rotation.
    - f. All fixtures shall be provided with color frame, power lead with mating grounded connector, safety cable, and c-clamp.
    - g. Fixtures shall be:
      - 1) Labeled with the Owner's mark and select numbering/labelling inventory scheme.
      - 2) Bench-focused, if necessary.
      - 3) Hung in the Owner's selected stock plot.
      - 4) Patched at the console.
- B. LED-type fixtures
  1. Provide (1) power pass-through and (1) DMX extension cable at 10 ft. length for each LED-type fixture included in the inventory. All cables shall adhere to requirements set for below in Cables and Accessories portion of this specification.
  2. All LED-type fixtures shall support ANSI E1.11 DMX512-A and ANSI E1.20 RDM standards.
  3. All LEDs used in the product shall be high brightness and proven quality from established and reputable LED manufacturers.
  4. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
- C. Fixtures – Type and Quantity
  1. Color-changing LED Zoom-style Profile

- a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
  - b. Unit shall have a shutter assembly with (4) blades mounted in two or more planes. Shutter blades shall be warp and burnout resistant;
  - c. Unit shall have two accessory slots, a top-mounted quick release gel frame retainer, and a slot with sliding cover for motorized pattern devices or optional iris.
  - d. Unit shall have projector-like quality pattern imaging, sharp shutter cuts without halation, and allow for both hard and soft beam edges;
  - e. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply;
  - f. Provide power lead with twistlock connector;
  - g. Unit shall support power and DMX in and thru connections;
  - h. Unit shall utilize an integral 25° -50° adjustable lens assembly;
  - i. Provide (1) 5-pin XLR terminator for every (5) fixtures
  - j. Quantity: (36)
  - k. Acceptable product:
    - 1) ETC ColorSource Spot jr Deep Blue
    - 2) Vari-lite Acclaim LED Zoomspot
    - 3) Chauvet Ovation E2-FC
2. Color-changing LED Wash
- a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
  - b. Unit shall have an accessory slot with a top-mounted quick release gel frame retainer.
  - c. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply.
  - d. Provide power lead with twistlock connector;
  - e. Unit shall support power and DMX in and thru connections.
  - f. Provide one (1) NSP, MFL, and WFL round field lens with each fixture.
  - g. Provide (1) 5-pin XLR terminator for every (5) fixtures
  - h. Provide with (6) barn door assemblies and floor-stand yokes with base.
  - i. Quantity (20)
  - j. Acceptable product:
    - 1) ETC ColorSource PAR Deep Blue
    - 2) Vari-lite Acclaim LED Fresnel
    - 3) Chauvet Ovation P-56FC
- D. Cables and Accessories
1. Extension Cables:
- a. Provide extension cables for extending pigtail or wall box circuits to lighting instrument.
  - b. Provide cable and connectors which meet or exceed the quality of cables and connectors set forth in this specification.
  - c. Provide each cable with Velcro cable tie.
  - d. Provide extension cable assemblies consisting of 12-gauge, 3 conductor flexible cable and 20A rated male and female grounded twist-lock connectors.
  - e. Quantity:
    - 1) (4) @ 5 ft.
    - 2) (4) @ 10 ft.
    - 3) (2) @ 25 ft.
    - 4) (1) @ 50 ft.
  - f. Acceptable Products:
    - 1) TMB & Associates ProPower
    - 2) Lex Products PowerFLEX
    - 3) Or approved equal
2. Adapter Cables
- a. Provide adapter cables for extending pigtail or wall box circuits to lighting instrument.
  - b. Provide cable and connectors which meet or exceed the quality of cables and connectors set forth in this specification.
  - c. Provide each cable with Velcro cable tie.
  - d. Provide extension cable assemblies consisting of 12-gauge, 3 conductor flexible cable and 20A rated male Edison connectors and female grounded twist-lock connectors.
  - e. Quantity:
    - 1) (6) @ 1ft. with Male Edison and female twist-lock connectors
    - 2) (6) @ 1ft. with Male twist-lock and female Edison connectors
  - f. Acceptable Products:
    - 1) TMB & Associates ProPower



- 2) Lex Products PowerFLEX
  - 3) Or approved equal
- 3. Two-fer:
  - a. Provide "Y" cables to connect two fixtures to a single receptacle.
  - b. Provide cable and connectors, which meet or exceed the quality of cables and connectors set forth in this specification.
  - c. Provide adapter assemblies consisting of 12-gauge, 3 conductor flexible cable and connectors of same specifications found in this section.
  - d. Quantity: (6)
  - e. Acceptable Products:
    - 1) TMB & Associates ProPower
    - 2) Lex Products PowerFLEX
    - 3) Or approved equal
- 4. DMX-512 cable
  - a. Provide DMX-512 cables for connecting lighting consoles, moving lights, or other DMX controlled accessories to the Network Nodes.
  - b. Connectors shall be Neutrik 5-pin.
  - c. Provide 24AWG two twisted pair data cable.
  - d. Insulation: polyethylene.
  - e. Nominal Impedance: 100 ohms.
  - f. Nominal Velocity of Prop.: 78%.
  - g. Capacitance between conductors: 12.5 pF/ft.
  - h. Quantity:
    - 1) (4) 5' DMX Cable
    - 2) (4) 10' DMX Cable
    - 3) (2) 25' DMX Cable
    - 4) (1) 50' DMX Cable
  - i. Acceptable Products:
    - 1) TMB & Associates ProPlex
    - 2) Lex Products PowerFLEX
    - 3) Or approved equal
- 5. Flexible Category 5e Cable/NET Cable:
  - a. Provide extra rugged, flexible control cable (Ethernet) for connection of NET stations to portable Network Nodes.
  - b. Cable to be 4-pair, double shielded, low-capacitance.
  - c. Conductors: 24 AWG tinned, annealed copper stranded 7 x 0.16.
  - d. Connector: Provide with EtherCon connector by Neutrik
  - e. Assembly: pairs cabled with Kevlar strength member.
  - f. Shield: (inner) aluminum/Mylar, 100% coverage (outer) tinned copper braid, 80% coverage.
  - g. Conductivity: 15ohms per 100 meters @ 20C.
  - h. Impedance: 100 ±15 ohms 1-100 MHz
  - i. Quantity:
    - 1) (4) 3' Ethernet Cable
    - 2) (4) 10' Ethernet Cable
    - 3) (2) 25' Ethernet Cable
  - j. Acceptable Products:
    - 1) TMB & Associates ProPlex
    - 2) Lex Products PowerFLEX
    - 3) Or approved equal
- 6. Color Medium Sheets
  - a. Provide standard and high temperature (HT) color medium
  - b. Color medium shall be selected by Owner
  - c. Provide (12) full size sheets (20"x24") of HT color filter
  - d. Acceptable product:
    - 1) Lee Color Filters
    - 2) Rosco Color Filters
- 7. Pattern Templates (Gobos)
  - a. Provide eight (8) stainless steel image patterns.
  - b. Size and patterns shall be selected by the Owner.
  - c. Acceptable product(s):
    - 1) Rosco Stainless Steel Gobos
- 8. Pattern Template Holders
  - a. Provide stainless steel metal pattern holders with plastic pull ring

- b. Quantity:
  - 1) (8) size A
  - 2) (8) size B
- c. Acceptable product(s):
  - 1) City Theatrical 2150 and 2160 sandwich holders
  - 2) Electronic Theatre Controls 400PH-A and 400PH-B pattern holders
- 9. Tie Line
  - a. Product will be a cotton line with polyester core
  - b. The blend will be a diamond braid construction
  - c. Product will be Black in color
  - d. Product will be unglazed
  - e. Product will be 1/8" in diameter
  - f. Product will be on original spool or reel
  - g. Provide 600'-0" spool
    - 1) Cut into 24" ties for dressing cable used in repertory plot
    - 2) Furnish the remainder of unused spool to Owner
  - h. Acceptable product:
    - 1) Rose Brand #4 Tie Line

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.
- B. The installation recommendations contained within the Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.
- C. Mount equipment and enclosures plumb and level.
- D. Permanently installed equipment to be firmly and safely held in place.
- E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

#### 3.2 INSTALLATION OF CABLE AND WIRING

- A. Verify installation of electrical work for this scope and all associated equipment with the overall Electrical installation. Provide all necessary equipment, including mounting hardware, for complete connection of power system wiring.
- B. Verify installation of power and ground wiring to equipment. Power and ground wiring will terminate inside of equipment and/or junction boxes and be hardwired to ground buss and circuit breaker to ensure uninterrupted operation.
- C. All control wiring will be executed in adherence to ANSI standards including the following:
  - 1. Isolate cables carrying signals at different levels and separate to restrict interaction.
  - 2. Keep wiring separated into three groups of conduit provided for control circuits, power circuits (up to 50 Amps), and feeder circuits (above 50 Amps).
  - 3. Isolate all wiring, except for safety ground wiring, from conduit ground.
  - 4. Take such precautions as are necessary to prevent and guard against electromagnetic and electrostatic interference in other technical systems (such as sound and communications systems) in the facility. Where possible all devices and wiring will be enclosed in a shielded environment. Take care not to use shields (conduits) and grounds as current carrying return paths for lamp and relay coil commons. All ground references are to be made to the building electrical system ground.
  - 5. Label unused wiring provided for spares or future systems and terminate at screw terminal strips.
  - 6. All joints and connections will be made with resin-core solder or with ratchet jaw crimp type mechanical connectors. Connect all circuits electrically in phase using same wire color code for similar circuits throughout the project.
  - 7. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.

8. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
9. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
10. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
11. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
12. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
13. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
14. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.
15. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
16. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.

### 3.3 INSTALLATION OF EQUIPMENT

- A. Take appropriate precautions against electrostatic discharge (ESD) when installing electronic equipment.
- B. Equipment to be installed in new condition, free of damages, scratches, dents, etc.
- C. Provide adequate ventilation in cabinet mounted equipment to maintain operating temperatures within range recommended by Manufacturer.
- D. All equipment will be installed in compliance with applicable Local and National Codes and Regulations.
- E. Equipment shall be installed in accordance with Manufacturer's requirements.
- F. Install lighting fixtures using standard industry practices. All lamps, lenses, and reflectors will be installed free of dirt, dust, and finger smudges. Do not use bare hands when handling conventional tungsten lamps. Ensure that a safety cable is properly applied with each fixture.
- G. Install lighting instruments to the standard house hang or repertory plot as directed by Consultant. Contractor shall document location of each type of distribution device and circuiting as part of as-built documents on plot. Provide pdf copy of plot to Consultant and Owner. Provide (2) full size printed copies of plot to Owner.

### 3.4 CONTRACTOR COMMISSIONING

- A. Prior to energizing or testing the System ensure the following:
  1. Physical installation is complete.
  2. Products are installed in proper and safe manner according to Manufacturer's requirements.
  3. Dust, debris, solder splatter, etc. is removed.
  4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
  5. Temporary facilities and utilities have been properly disconnected and removed.
  6. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded. The jobsite shall be broom clean.
- B. Contractor shall:

1. Retain the services of a Manufacturer certified technician to check the installation and ensure its proper operation. No part of the Theatrical Lighting System may be energized before this technician has checked and approved the System installation.
  2. Test all lighting load circuits for the following:
    - a. Continuity
    - b. Nominal voltage
    - c. Polarity
    - d. Accuracy to the Distribution Schedule as enumerated in the drawings.
  3. Test controls wiring for the following:
    - a. Appropriate wire types and quantities
    - b. Control wire distance from source
    - c. Terminations meet Manufacturer requirements
- C. The following identifies some, but not all, of the commissioning tasks of the commissioning team. This list is not intended to be comprehensive and should be considered a general guideline for the Contractor without a defined commissioning process statement:
1. Program all power distribution panels
  2. Setup and program all network control devices
  3. Setup and initial programming of control console
  4. Setup and initial programming for all architectural control devices
  5. Program all emergency lighting control devices

### 3.5 FINAL OBSERVATION & TESTING

- A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Consultant.
- B. Testing will include operation of each major system and any other components deemed necessary. Contractor will assist in this testing and provide all test equipment noted below. Contractor shall provide at least two (2) technicians available for the entire testing period (day and night), to assist in tests, adjustments, and final modifications. Testing process is estimated to take a minimum of one (1) day.
- C. Provide the following test gear:
1. Circuit Tester with adapters for all connectors present in the system.
  2. Multimeter capable of measurements up to 600V AC/DC, 10A DC, and 2MOhms
  3. DMX Tester
  4. Industrial Ethernet Tool capable of testing signal continuity and distance from source
- D. The following procedures will be performed on each System:
1. Observation of the physical installation including labeling, mounting, and finish of all equipment and components which are a part of the System.
  2. Functional testing of all control devices and devices under control within the System.
  3. Review of programming and standard settings for all control interface devices.
  4. Load circuit verification.
  5. Control circuit verification.
  6. Other tests on equipment or systems deemed appropriate.
- E. The Consultant will provide the Owner with a listing describing any incomplete or otherwise deficient items determined as part of the testing process. Where further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is complete.

### 3.6 INSTRUCTION OF OWNER PERSONNEL

- A. Provide operations and service training on all equipment incorporated in the System.
- B. Training shall not be conducted until final observation and testing is completed by the Consultant, unless otherwise directed by the Owner.
- C. Provide (8) hours of training. Training time shall be conducted in multiple sessions, with each session not to exceed four hours. Training shall be conducted in accordance with Owner's schedule.

1. Six months after completion of initial training, schedule an additional (4) hours with Owner for review of systems and equipment operation.
- D. The major equipment components and subject matter are as follows (advisory percentage of overall time allocated):
1. Power Distribution System (20%)
    - a. Basic testing and control
    - b. Normal and emergency operations
    - c. Programming memory
    - d. Software configurations and upgrades
    - e. Troubleshooting.
  2. Control Console (40%)
    - a. Operational training, including offline or remote-access software
    - b. Patching and programming
    - c. Fixture integration
    - d. Peripheral hardware
    - e. Applications interface for retrieving information from the control console
    - f. Troubleshooting
    - g. Upgrades
  3. Architectural Controls (20%)
    - a. Part of training will be to establish programmed looks for the performance areas with the end-user. The Contractor shall provide all equipment to establish DMX values for preset looks.
    - b. Snapshotting preset onto DMX controller
    - c. Preset recall operation
    - d. Normal operations (e.g., console arbitration, time-clock controlled events, etc.)
    - e. Troubleshooting.
  4. Theatrical Lighting Fixtures and Accessories (20%)
    - a. Hang and focus
    - b. Cabling and circuiting
    - c. Setup and DMX addressing
    - d. Troubleshooting
- E. Training Schedules
1. Training should be assumed to take place on the project site.
  2. Training should be scheduled to be non-overlapping.
  3. Actual training schedule shall be by agreement with Owner.
  4. In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time.
- F. Submit an outline of the course with sample instructional aides for approval thirty (30) days prior to scheduled instruction sessions to architect and architect's consultant.
- G. Following discussions with Owner, provide a Training submittal 2-4 weeks prior to first training. Submittal shall:
1. Include a separate page/entry for every training session.
  2. Indicate date, time, and approximate length of training session.
  3. Indicate person(s) conducting training.
  4. Indicate whether training will be video recorded.
  5. Intended curriculum and most appropriate attendees (e.g., technician, operations, IT, etc.)
  6. Include signature and title lines for:
    - a. Owner acknowledging and accepting training schedule. Include both an Accepted and Rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
    - b. Countersigning by trainer indicating that training actually occurred.
    - c. All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
    - d. Owner's representative attending training at the end of the session shall initial that:
      - 1) Training Occurred.
      - 2) Training Materials were provided and left with Owner
      - 3) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.

- 4) Training was generally sufficient for the proposed curriculum.
- 7. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)
- H. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

### 3.7 EVENT ATTENDANCE

- A. Contractor shall attend the first facility use or event as directed by the Owner.
  - 1. Event Attendance includes the following requirements:
    - a. Attendance shall begin at the first crew call and conclude when the crew is released. During these events perform such tasks (e.g., assistance with patching, programming, troubleshooting cabling problems, etc.) as requested by User. Tasks shall be strictly assistance, not operation.
    - b. Event support personnel shall be a technician associated with the original installation and commissioning.
    - c. In the event that the system is used prior to final acceptance, attendance in support of system usage shall not be construed as acceptance or as event attendance.
  - 2. Coordinate these schedules with the Owner.

END OF SECTION 11 61 62

SECTION 11 68 00

PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Miscellaneous items such as galvanized field corner markers; track finish line markers; tennis court nets, posts and tennis net anchors; and tennis back boards.
- B. Related Sections:
  - 1. Section 32 18 13 - Synthetic Grass Surfacing.
  - 2. Section 32 18 14 - Paved Elastic Layer
  - 3. Section 32 18 23.39 - Synthetic Running Track Surfacing.
  - 4. Section 32 18 23.59 - Synthetic Tennis Court Surfacing
  - 5. Section 32 31 13.26 - Chain Link Fences - Tennis Courts; Windscreens

1.2 SUBMITTALS

- A. Shop Drawings:
  - 1. Submit shop drawings for each product in accordance with Section 01 33 23
  - 2. Indicate details of fabrication, anchorage, and related construction. Indicate accessories and finishes.
- B. Delegated Design: Submit structural calculations and shop drawings prepared by manufacturer for review by project engineer. Shop drawings and calculations shall be sealed by a professional engineer registered in the State of Texas. Engineer shall have a minimum of 5-years' experience with projects of similar scope.

1.3 WARRANTY

- A. Provide 3-year warranty.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Finish Line Markers: Finish line markers shall be 2" in diameter galvanized pipe sleeve, 24" long set in 12" diameter concrete footing, 30" deep.
- B. Radius Point and Corner Markers: 1" diameter galvanized steel pipe as detailed, complete with 2" diameter rubber cover.
- C. Corner Marker Pylons: Pylons shall be 4"x4"x18" foam covered with vinyl as manufactured by BSN Sports, (800) 527-7510, or approved equal.
- D. Field Event Equipment: Field event equipment shall be as manufactured by Aluminum Athletic Equipment Co., (800) 523-5471, as listed below or approved equal.
  - 1. Shot Put Toe Board - #ATBC.
  - 2. Shot Put Ring - #SC.
  - 3. Discus Ring - #DC.
  - 4. Discus Cage and Nets - HSDC with offset Barrier Net BN-HSDC
  - 5. Pole Vault Box and Cover - #SSVB.
  - 6. Long Jump/Triple Jump Off Boards - HTB-8.
- E. Tennis Posts and Nets: Tennis nets and posts shall be one of the following (nets shall be supplied with center strap):
  - 1. Laykold Tennis Post and Net as supplied by Sportec International, Inc., (800) 638-5851.
  - 2. Patterson-Williams Tennis Post Model No. 2205 with Net Model No. 8353 as supplied by the Paul Allen Co., Inc., (800) 869-9518.
  - 3. Edward's "Tournament" tennis posts with Model 30DS "Tournament" Nets as supplied by Brownell, Inc., (800) 243-2512.
  - 4. M. Putterman and Co., Model - Regal Post with Maxi Net, (800) 621-0146.

- F. Net Anchors: Net anchors shall be flush-mounted galvanized steel anchors as manufactured by American Tennis Accessories, Inc., or approved equal.
- G. Tennis Back Board: Bakko Backboards "Economy Series" or approved equivalent product.
  - 1. Fiberglass faced panels with sound deadening materials and finished with polyurethane topcoat. Provide all hardware and fasteners required for installation.
  - 2. Size of backboard assembly: Length and height as shown by drawings with bottom of panels 12 inches above surface of court.
  - 3. Color: Manufacturer's standard green.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Field Corner and Finish Line Markers: Install as shown on the drawings. Use proper surveying equipment to assure accurately of location.
- B. Radius Point Markers: Set markers in concrete as shown on the plans.
- C. Field Event Equipment: install as shown on the drawings and as recommended by the manufacturer.
- D. Tennis Net Post and Sleeves: Install net posts per detail on the drawings. Sleeves shall be installed in exact upright, plumb position.
- E. Tennis Nets: Install nets per manufacturer's recommendations.
- F. Net Anchor: Install flush mount net anchor in concrete slab at center of each net.
- G. Tennis Back Board: Install in strict compliance with manufacturer's printed instructions and recommendations.
  - 1. Apply white tape line completely across all panels; top of tape line 42 inches above surface of court at edges of backboard assembly and 36 inches above court surface at center of assembly. Apply a 4-inch-long vertical white tape strip at center.

END OF SECTION



## SECTION 12 21 13

### HORIZONTAL BLINDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Horizontal blinds.
- B. Related Sections:
  - 1. Section 08 11 00 - Hollow Metal Doors and Frames; glazed openings.
  - 2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.

##### 1.2 SYSTEM DESCRIPTION

- A. Horizontal metal slat louver blinds installed at storefront, curtain wall, glazed openings, and mirrors; manual control of raising and lowering by cord; blade angle adjustable by control wand. Horizontal blinds shall be indicated as "HB" on the drawings.

##### 1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Include manufacturer's catalog cuts and data sheets, and installation instructions and data certifying blinds are lead-free.
- C. Shop Drawings: Include details of attachment and schedule of each size and location.

##### 1.4 QUALITY ASSURANCE

- A. Measurements: Provide custom size blinds for the openings or mirrors in which they are to be installed. Take careful measurements of each opening so that the blinds will fit properly. Plan dimensions shall not be used. Verify head, jamb, and sill conditions.
- B. All blinds shall be lead-free.

##### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.
- B. Deliver blinds wrapped and crated in a manner to prevent damage to components or marring of surfaces.
- C. Store and protect products under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
- D. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

#### PART 2 - PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. Horizontal Blinds: 1" wide by 0.0085" thick slat type, with valance for each blind. Product/manufacturer; one of the following:
  - Bali Classics Mini Blinds; Springs Window Fashions Division, Inc.
  - Levolor 1" (25mm) Riviera Classic Blind; Levolor Corp.

## 2.2 MATERIALS AND FABRICATION

### A. Horizontal Blinds:

1. Head channel shall be 0.025" thick Tomized steel with a plastic type coating. Channel shall be "U" shaped, approximately 1" high be 1-9/16" wide, with flanged edges at the top.
2. Slat supports shall be braided of polyester yarn. The vertical component shall have a diameter of not less than 0.045" nor greater than 0.066". Braiding shall be accurate to hold slats equally spaced, parallel and straight, and to assure proper tilt control and adequate overlay of slats. Provide 31 rungs per 2 feet of ladder, equally spaced. Distance between ladders shall not exceed 21". The horizontal component shall consist of not less than four cables interbraided with the vertical component.
3. Slats shall be virgin aluminum alloy approximately 1" wide by 0.0085" thick. Slats shall have sufficient crown to prevent sagging and radius corners.
4. Bottom rail shall be 0.023" thick Tomized steel with a plastic type coating.
5. Tilter shall be Tomized steel of enclosed construction. Unit shall tilt the slats to any desired angle and hold them at that angle. An automatic disengagement of worm and gear shall eliminate overdrive to prevent strain or damage to wand, worm, gear, ladder or top slat. Operation shall be by wand of sufficient length and swivel for easy operation.
6. Lift cord shall be of adequate diameter, braided of high strength synthetic fibers.
7. Finish: The factory finish for the exposed surfaces shall be a plastic type finish coat baked on. Color shall be as selected by Architect from manufacturer's standard color range.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive blinds for conditions which will adversely affect the installation of the blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Attach installation end brackets at each end of blind location. For blinds over 55" long or over 50 square feet in area, provide intermediate brackets.
- B. Blinds shall be mounted in brackets inside frame jambs by skilled mechanics under the supervision of an authorized representative of the manufacturer. The completed blinds shall be left clean and in perfect working order. Crates, cartons, and rubbish shall be removed from the premises; rooms shall be left broom clean.

### 3.3 TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4".
- B. Maximum Offset From Level: 1/8".

### 3.4 ADJUSTING

- A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.
- B. Adjust blinds for smooth operation.

### 3.5 CLEANING

- A. Clean work under provisions of SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Plastic laminate-faced casework as shown on drawings.
  - 2. The fabrication and installation of standard casework components of base cabinets, wall cabinets, storage cabinets, wardrobe cabinets, shelf units and other units as indicated.
  - 3. The fabrication and installation of custom units, as detailed in the drawings.
- B. Related Sections:
  - 1. Section 06 10 00 - Rough Carpentry; blocking.
  - 2. Section 06 40 00 - Architectural Woodwork - Specialty cabinetry.
  - 3. Section 08 14 23 - Plastic-laminate-faced Wood Doors
  - 4. Section 09 65 00 - Resilient Flooring; coved rubber base.
  - 5. Section 11 31 00 - Appliances
  - 6. Section 22 40 00 - Plumbing Fixtures

1.2 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions for each type of casework unit.
- B. Samples: Submit 6" x 6" samples of specified finishes, including top material. Samples will be reviewed by Architect for color, texture and pattern only. Compliance with other specified requirements is exclusive responsibility of contractor.
- C. Shop Drawings:
  - 1. Submit shop drawings for plastic laminate-faced casework showing plans, elevations, ends and cross-sections. Show details and location of anchorages and fitting to floors, walls and base. Include layout of units with relation to surrounding walls, doors, windows and other building components.
  - 2. Coordinate shop drawings with other work involved.
- D. Mock-up Casework:
  - 1. Submit one full-size sample of finished base cabinet unit complete with hardware, doors and drawers, without finish top.
  - 2. Submit one full-size sample of finished wall-mounted cabinet unit complete with hardware, doors and adjustable shelves.
  - 3. Furnish both hinged and rolling door samples.
  - 4. Acceptable sample units will be used for comparison inspections at project. Unless otherwise directed, acceptable sample units may be incorporated in work. Notify Architect of their exact locations. If not incorporated in work, retain acceptable sample units in building until completion of work and remove sample units from premises when directed by Architect.

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide casework with tops and accessories manufactured or furnished by same casework company for single responsibility.
- B. Catalog Standards:
  - 1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction and workmanship.
  - 2. Custom units shall be of the same quality as standard units specified.

- C. AWS Quality Standard: Comply with grades of interior architectural woodwork, construction, finishes and other requirements of the "Architectural Woodwork Standards", 2nd Edition, 2014, adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), except as otherwise indicated.
  - 1. Use Premium Grade, except use Economy Grade for millwork in custodian closets and storage rooms. Items not given a specific quality grade shall be Premium Grade.
- D. Color Uniformity: Provide plastic laminate for laminate-clad casework, plastic faced wood doors and plastic laminate toilet compartments from the same manufacturer.
- E. Manufacturer shall have at least 5 years' experience and have done installations for similar types of projects.
- F. Accessibility Standards: The following special requirements shall be met, where required to comply with Texas Accessibility Standards (TAS).
  - 1. Countertop height with or without cabinet below, not to exceed a height required by TAS.
  - 2. Kneespace clearance to be minimum clearance as required by TAS.
  - 3. 12" deep shelving, adjustable or fixed not to exceed a range as required by TAS.
  - 4. Wardrobe cabinets to be furnished with rod/shelf adjustable to 48" A.F.F. at a maximum 21" shelf depth.
  - 5. Sink cabinet clearances as required by TAS.
  - 6. Cabinet locks, latches, and other operating mechanisms shall be mounted to comply with forward reach requirements of TAS; i.e. 15" to 48" above finish floor, except locked bottom drawers at base cabinets.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plastic laminate-faced casework only after wet operations in building are completed.
- B. Store completed plastic laminate-faced casework in a ventilated place, protected from the weather, with relative humidity therein of 50% or less at 70°F.
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering. Woodwork damaged through neglect of the above requirements shall be repaired or replaced without additional cost to the Owner.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install finish carpentry products only when temperature and humidity conditions have been stabilized and will be maintained.
- B. Maintain temperature and moisture conditions as recommended by woodwork fabricator from date of installation through remainder of construction period.

#### 1.6 GUARANTEE

- A. Provide 5-year guarantee against defective materials and workmanship.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design: Manufacturer's catalog numbers for Case Systems, Inc. (website: [www.casesystems.com](http://www.casesystems.com), phone 989-496-9510) are shown on drawings and included in specifications for convenience in identifying certain cabinet work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet, hardware, or equipment.
- B. Subject to compliance with requirements of this specification, Case Systems, Inc. equivalent plastic laminate-faced casework as manufactured by one of the following will be acceptable:
  - CIC Concepts in Cabinetry
  - Jericho Woodworks
  - Jim R. Reynolds & Assoc.

## 2.2 GENERAL

- A. Decorative laminate casework shall be Case Systems as specified or approved equal with the following minimum features:
1. M-3i 47# density engineered particleboard for cabinet components meeting or exceeding all requirements as set by ANSI A208.1-2009.
  2. PVC edges applied with hot melt.
  3. Epoxy coated, self closing, minimum 150# static rated drawer slides with lifetime warranty.
  4. Non-Racking, Non-Deflecting Platform Drawer Box With 1/2" Thick Bottoms.
  5. 1/2" Thick Cabinet Back.
  6. "Balanced" High pressure laminates applied with rigid PVA glue.
  7. Thermally Fused Laminate Interior, excluding backs of doors and drawers, complying with requirements of NEMA LD3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
  8. Each Cabinet to have a factory applied, separate and full support toe base construction.
  9. Colors and finishes shall be as selected by Architect.
  10. Casework shall be independently tested to meet the following minimum performance values:

Base Unit Racking	1460 lbf
Base Front Joint Loading	725 lbf
Wall Unit Racking	1600 lbf
Wall Unit Static Load	2500 lbf
Drawer Unit Static Load	1050 lbf
Drawer Front Joint Load	805 lbf
Drawer Side Joint Load	450 lbf
  11. Rail mounted casework shall be vertically and horizontally adjustable.
  12. Rail mounted casework shall have integral lower leveling bar, adjustable from inside of cabinet.
- B. Color and finish selections: Architect reserves the right to select one color for the exposed surfaces of the basic components of cabinets and a different color for the following components of cabinets: door and drawer fronts (including edges of door and drawer fronts), backs of open shelving and countertop and backsplash, unless shown otherwise.

## 2.3 MATERIALS

- A. Exterior Vertical Surfaces:
1. Door and drawer fronts and backs, finished end panels, and exposed exterior backs shall be surfaced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.
  2. Exterior vertical high-pressure laminate panels shall be balanced with textured .020" thick high-pressure cabinet liner conforming to NEMA Standard LD3-1995. Color as selected by Architect. Surface texture shall be similar to exterior finish.
  3. High-pressure laminate must be laminated using a PVA adhesive, set under pressure, resulting in a rigid glue line. Contact adhesives shall not be used.
  4. HPDL at open interiors, underside of wall cabinet bottoms, interiors of glazed door cabinets shall be considered exposed and finished in Decorative High-Pressure VGS laminate.
- B. Plastic Laminate: General purpose grade, HGS (0.048") high pressure decorative laminate meeting requirements of NEMA LD 3. Colors shall be as selected by Architect from full color, finish and pattern range of plastic laminate manufacturers listed. Product/manufacturer: As scheduled; refer to Material Finish Schedule or equivalent approved product.
- Formica Brand Laminate; Formica Corp.  
Nevamar or Pionite Decorative Laminate; Panolam Industries.  
Wilsonart; Wilsonart LLC.
- C. Thermally Fused Interiors at Semi-Exposed Surfaces: Interior surfaces behind doors, drawer boxes, backs, and unfinished ends shall be laminated with a thermally fused laminate that meets or exceeds the performance standards for NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Panels shall be of "BALANCED" construction. Fast cycle thermally fused, melamine foil or polyester surfaced panels or other surface types that do not meet these requirements are not acceptable. This excludes backs of doors and drawers, which shall be balanced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.
- D. 3mm PVC Edges: Door and drawer edging shall be 3mm PVC. The PVC shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Hand tool applying and trimming of PVC shall not be allowed. Edging shall be available in TWENTY TWO coordinated color options.

E. Particleboard:

1. Particleboard shall be Grade M-3i, Industrial, according to the American National Standard (ANSI) for Mat-Formed Wood Particleboard, ANSI-A208.1-2016 and shall meet or exceed the following:
  - a. Density 50 lbs/cu.ft.
  - b. Moisture Content: Meet or exceed M-3i Grade, according to ANSI-A208.1-2016
  - c. Modulus of Rupture 2176 psi
  - d. Modulus of Elasticity 362,600 psi
  - e. Internal Bond 73 psi
  - f. Linear Expansion 0.40%
  - g. Thickness Tolerance +/- 0.008"
  - h. Face Screw Holding 225 pounds
  - i. Edge Screw Holding 202 pounds

## 2.4 CASEWORK HARDWARE AND ACCESSORIES

- A. Provide manufacturer's standard, satin finish hardware units, unless otherwise indicated.
- B. Hinges: Concealed hinges of heavy gauge metal construction, with hinge manufacturer's lifetime warranty. 170° swing. Hinge shall have six-way adjustment. Doors to be self-closing, and fitted with silencer bumpers. Provide HH050 concealed hinge.
- C. Wire Pulls: Solid brass with dual chrome finish, 4" wide, for drawers and swing doors, mounted with two screws fastened from back. Provide two pulls for drawers over 24" wide.
- D. Door Catches:
1. Dual self-aligning, heavy-duty permanent magnet type with resistance in compliance with the Americans with Disabilities Act and Texas Accessibility Standards. Provide two catches on doors over 4' high.
  2. At double-leaf doors, provide lvs No. 2 catch for leaf without the lock. Four screws per catch.
  3. At each 1-1/8" doors, provide 1 flap stay No. 499.050.02.0215 or 499.050.03.0215 (Mepla) or approved equivalent.
- E. Drawer Slides and Accessories:
1. Standard Drawers: Case DS230, self-closing design, epoxy powder coated with positive in-stop. Captive nylon rollers, front and rear. Minimum 100 lb. load rating.
  2. File Drawers: Case DS430, full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
  3. File Drawer Rails: Case FR010, file drawer box shall have full height sides supporting the plastic file rails for hanging file folders.
  4. Paper Storage Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
- F. Drawer and Cabinet Locks: Provide National Lock No. C8053-14A, half-mortise type, disc tumbler locks, round cylinder only exposed. Locks to be keyed differently, with locks in individual rooms keyed alike. Provide a masterkey.
1. Cabinet locksets shall allow for 90/180 degree locking and allow removal of key in both locked and unlocked position. "Clinic" locks shall function so that key can be removed only when in "LOCKED" position.
- G. Cabinet Base Molding: To be provided by General Contractor in field.
- H. Adjustable Shelf Supports: Provide twin pin design with anti tip-up shelf restraints for both ¾" and 1" shelves. Design to include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating to be minimum 300 lbs. each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection. Product/manufacturer; one of the following, no substitutions:
1. #3206 Shelf Support; Bainbridge Manufacturing, Inc.
  2. SC240 Plastic Shelf Clip; Case Systems, Inc.
  3. Cat. No. 282.47.402; Häfele
  4. Clear Polycarbonate Shelf Clip; TMI System Design Corp.
- I. Wardrobe Rod: To be 1-1/16" rod, Knappe & Vogt No. 660, supported by Knappe & Vogt No. 632 CHR flanges.
- J. Shelf and Rod Hardware:
- 1 hanger rod KV660SS
  - 1 shelf and rod support KV1195

- 2 rod flanges KV734  
wood dowel connectors
- K. Removable Modesty Panel Brackets: At sinks, provide ADA modesty panel brackets from one of the following providers:  
Model PRODDLMPBWH; Wurth Wood Group (704-394-9479, [www.wurthwoodgroup.com](http://www.wurthwoodgroup.com))  
ADA EZ-Kick; EZ-Kick (805-748-1652, [www.adatoekick.com](http://www.adatoekick.com))
- L. Countertop Support Bracket, non-concealed where shown: Case Systems, Inc. Model X0670
1. 11 gauge construction
  2. Powder-coated finish in color as selected by Architect.
  3. Load rating of 200 lbs. per lineal foot.
- M. Steel Support Brackets for countertops, concealed where shown: Provide one of the following:
1. Concealed Work Station Brackets formed of 1/8-inch steel with powder coat finish as manufactured by A & M Hardware, Inc. (phone 888.647.0200 web site: [www.aandmhardware.com](http://www.aandmhardware.com)). Color as selected by Architect from manufacturer's full color line.
  2. Concealed Model EH-FM Series Rakks Counter Support Brackets fabricated of minimum 0.25-inch gauge 6063-T6 extruded aluminum as manufactured by Rangine Corp. (phone 800.826.6006 web site: [www.rakks.com](http://www.rakks.com)). Brackets shall be TIG welded along both 45° mitered sides and across the back. Sharp edges shall be ground and deburred. Color and finish shall be as selected by Architect.
- N. Grommets:
1. Max2/A-94 as manufactured by Doug Mockett & Co., Inc.
  2. Trash Grommets: 8" x 2" Round Trash Grommet Model No. TM2B SSS Satin Stainless as manufactured by Doug Mockett & Co., Inc.
- O. Keyboard Tray: Knappe & Vogt SD-04-18 Keyboard/Mouse, 6" adjustable arm, 18" track and 25" keyboard/mouse platform to accommodate right or left hand mousing.

## 2.5 CONSTRUCTION

- A. Cabinet body components shall be secured utilizing concealed interlocking mechanical fasteners as approved by the "Architectural Woodwork Standards", 2nd Edition, October 1, 2014, as adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), Section 10 and Appendix A. They shall be especially designed for use in joining particleboard panels.
- B. Joints are tight fitting and will not rupture or loosen due to the following:
1. Dimensional changes in the particleboard.
  2. Racking of casework during shipment and installation.
  3. Normal use.
  4. Fastening devices and screws shall be treated to deter or resist corrosion.
- C. Construction Features:
1. Structural components shall be 3/4" thick with balanced surfaces.
  2. Back panels shall be 1/2" thick surfaced both sides for balanced construction.
  3. Drawer components shall be 1/2" thick surfaced both sides for balanced construction.
  4. Mounting stretchers are 3/4" thick structural components fastened to end panels by mechanical fasteners, and are concealed by the cabinet back.
  5. Maintain a 1/8" max. reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
  6. When the rear of cabinets are exposed, a finished 3/4" thick decorative laminate back panel is applied.
  7. Exterior grade plywood core individual bases, factory applied to base and tall cabinets shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall. Also to conceal the top edge of applied rubber base molding. There shall be a front to back center support for bases over 30" wide.
  8. Horizontal parting rails between drawers shall be 3/4" particleboard with balanced surfaces, secured to and further reinforcing cabinet ends. When drawers are keyed individually within a cabinet, or when drawers are fitted with lock hasps, the parting rail shall run full depth of cabinet to prevent pilfer.
  9. A 5mm diameter row hole pattern 32mm (1-1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.

10. Door and drawer fronts and finished ends shall be balanced construction with "high-pressure" laminate bonded to both sides of a M-3i, 47# particleboard core.
  11. Doors over 24" wide or 80" high shall be 1" thick.
  12. Adjustable shelves shall be particleboard core, balanced surfaces and have a .020" thick PVC front edge. Per AWS, shelving shall not deflect in excess of 1/4" when loaded.
    - a. Adjustable shelves behind doors, 3/4" thick to 27" wide, over 30" wide shall be 1" thick min.
    - b. Adjustable shelves in open cabinets shall be 1" thick, except for special use cabinets such as mail, cubical or locker type units.
    - c. There shall be no play in adjustable shelves 1/16" each end, max.
  13. Fixed Interior Components such as fixed shelves, dividers, and cubicle compartments shall be full 3/4" thick particleboard attached with concealed interlocking mechanical fasteners.
- D. Wall Cabinets:
1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
  2. Wall cabinet bottoms shall be of 1" thick particleboard core mechanically fastened to end panels and secured to the bottom back stretcher.
  3. An upper 3/4" thick stretcher shall be located behind the back panel with two interlocking mechanical fasteners per end. Also the stretcher is secured to the cabinet top with #8 x 2" plated flat head screws.
  4. A lower 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. The stretcher is also secured to the cabinet bottom.
- E. Base Cabinets:
1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
  2. Base cabinets, except sink cabinets, shall have a solid 3/4" thick sub-top fastened to the ends with interlocking mechanical fasteners.
  3. Each kneespace to have apron with dimensions per drawings.
  4. Provide 1-1/2" thick dividers between kneespaces and adjacent spaces (e.g. dishwasher openings, other kneespaces, etc.)
  5. Sink cabinets shall have a vertically mounted front stretcher panel supporting the countertop, a split removable back panel, and four steel corner gussets used to secure the counter-top.
  6. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
  7. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.
- F. Tall Cabinets:
1. Each end panel to be secured with a minimum of eleven interlocking mechanical fasteners for a total tensile strength of 3,850 pounds.
  2. An intermediate fixed shelf shall be provided on general storage cabinets to maintain internal dimensional stability under heavy loading conditions.
  3. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
  4. An intermediate 3/4" thick stretcher shall be located behind the back panel and be secured to the cabinet ends with interlocking mechanical fasteners. Where an intermediate shelf is present, the stretcher shall also be secured to the shelf with a #8 x 2 plated flat head screw.
  5. Drawers with 1/4" bottoms requiring hot melt glue or intermediate supports will not be permitted. No exceptions will be permitted.
  6. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.
- G. Drawers:
1. Drawer box shall be constructed with a full 1/2" thick non-racking, non-deflecting platform bottom which is carried directly by "L" shaped, bottom mount drawer glides. Sides are secured with 1 1/4" long screws directly into platform and into the sides.
  2. Sides, back, sub-front and bottom shall be 1/2" thick 47# density particleboard surfaced both faces with Light Beige, Greystone, or White thermally fused laminate per 2.02.B.1. The top edge shall be .020" PVC matching the drawer color.
  3. Corners shall be joined with fluted hardwood dowels and glue, minimum 32mm o/c.
  4. Drawer fronts shall be removable and attached drawer box sub-front with screws from inside of drawer.



## 2.6 PERFORMANCE

- A. Laminates:
  - 1. "High Pressure Laminates" shall meet the definition and performance requirements of NEMA LD3-1995. Vertical grade laminate shall be VGS (0.028") balanced with a VGS. Countertops shall be HGS (0.048").
  - 2. Thermally Fused Laminate shall meet the performance requirements of NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Cabinet manufacturer shall submit panel manufacturers' current published specification stating ANSI core properties and NEMA finish properties.
- B. Hinges: ANSI 156.9.4.1,2,3,4: Two hinges mounted 23" on center on a 23-7/16" wide x 19-11/16" high cabinet door shall be capable of supporting a 100 pound test load located 1" from the outside edge of the door.
  - 1. Cycle, open and close, from 5 degrees open through 95 degrees open with no failure to hinges, door, or cabinet end panel. The maximum horizontal permanent hinge set shall not exceed .030".
- C. Drawers: ANSI/BHMA A156.9-1988 4.11: an actual production drawer box with an applied finished front and 450mm drawer slides mounted per the manufacturers' instructions shall be tested as follows:
  - 1. Dynamic Cycle Test: When uniformly loaded with 100 pounds and tested through 50,000 opening and closing cycles, the drawer shall operate freely.
  - 2. Static Edge Load Test: When the drawer is fully extended, a 150 pound load shall be supplied to the drawer front at a point on the centerline of the drawer for one minute. No permanent damage or distortion shall occur.
- D. Adjustable Cabinet Shelving: Shelving shall not deflect in excess of 1/4" when loaded with calculations per AWS Standards.

## 2.7 COUNTERTOPS

- A. High-Pressure Decorative Laminate, Nominal 1" Thick Countertop (where shown):
  - 1. General Purpose, HGS (0.048") high-pressure decorative laminate on horizontal surface, conforming to NEMA Standard LD3-1995.
  - 2. Laminate bonded to 1" thick 45# M-3i particleboard core with PVA rigid adhesives. Contact method shall NOT be allowed. Core shall be balanced with HPL backer.
  - 3. Provide with 1-1/2 inch deep face edge, faced with high pressure laminate unless noted or shown otherwise.
  - 4. Joints shall be secured with adhesive and tight joint fasteners.
  - 5. Provide 4" high back splashes where shown and at ends abutting walls and adjacent cabinets.
  - 6. Countertops shall conform to ANSI A161.2-1979 PERFORMANCE STANDARDS FOR FABRICATED HIGH-PRESSURE DECORATIVE LAMINATE COUNTERTOPS.
  - 7. No joints shall be closer than 24" either side of sink cutout.
  - 8. No joints shall occur within kneespace.
  - 9. Countertops containing sinks and countertops over dishwashers shall be exterior-grade veneer core plywood or moisture resistant medium density fiberboard, no substitutions.
  - 10. Joint between backsplash and countertops containing sinks shall be sealed with sanitary, silicone sealant to ensure a tight seal.
  - 11. Seal substrate at sink cutouts with sanitary, silicone sealant.
- B. Quartz Agglomerate Countertops and Windowsills (where shown): As specified in Section 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS.

## 2.8 FABRICATION

- A. Fabricate plastic laminate-faced casework to dimensions, profiles and details shown.
- B. Assemble units in the shop in as large components as practicable to minimize field jointing.
- C. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to a flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify site dimensions of cabinet locations in building prior to fabrication.
- B. Verify location of wood blocking prior to installation of finish carpentry.

### 3.2 CASEWORK INSTALLATION

- A. Installers: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics certified by manufacturer.
- B. General: Install plumb, level, true and aligned with no distortions. Shim as required, using concealed shims. Where casework abuts other finished work or walls, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.
- C. Base Cabinets:
  - 1. Set cabinets straight, plumb and level. Adjust sub-tops within 1/16" of a single plane. Fasten each individual cabinet to blocking in wall with screws and finishing washers spaced 24" o.c. Bolt adjacent cabinets together into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16".
  - 2. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24" o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- D. Wall Cabinets
  - 1. Securely fasten to solid blocking in partitions (not plaster, lath, or wallboard). Anchor, adjust and align wall cabinets as specified for base cabinets. Using screws with finishing washers, securely fasten each cabinet through back, near top, at not less than 24" o.c. Align similar adjoining doors to a tolerance of 1/16".
  - 2. Adjust fronts and bottoms within 1/16" of a single plane.
  - 3. Reinforcement of stud walls to support wall-mounted cabinets will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.
- E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

### 3.3 INSTALLATION OF TOPS

- A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no jobsite processing of top and edge surfaces.
- B. Fastenings: Use concealed clamping devices for field joints, located within 6" of front, at back edges and at intervals not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Secure tops to cabinets with "Z"-type fasteners or equivalent, using two or more fasteners at each front, end and back.
- C. Workmanship:
  - 1. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Provide flush hairline joints in top units using clamping devices.
  - 2. After installation, carefully dress joints smooth, remove surface scratches, clean and polish entire surface.
  - 3. Provide holes and cutouts as required for mechanical and electrical service fixtures.
  - 4. Provide scribe moldings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use permanently elastic sealing compound recommended by manufacturer.

### 3.4 INSTALLATION OF ACCESSORIES

- A. Install in a precise manner in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

- B. Demonstration Mirror: Position mirror supports with mounting plates where shown on drawings. Fasten pre-drilled mounting plates to structure with bolts. Level supports to ensure mirror rotation.
- C. Install grommets at knee spaces where electrical/telephone/data outlets are installed below countertop, whether detailed on drawings or not.

### 3.5 CLEANING AND PROTECTION

- A. Clean Up: Remove cartons, debris, sawdust, scraps, etc., and leave spaces clean and casework ready for Owner's use.
- B. Repair or remove and replace defective work as directed upon completion of installation.
- C. Clean shop-finished surfaces, touch-up as required and remove or refinish damaged or soiled areas, as acceptable to Architect.
- D. Protection: Advise contractor of procedures and precautions for protection of materials and installed plastic laminate-faced casework from damage by work of other trades.

END OF SECTION

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SECTION 12 32 20

MUSICAL INSTRUMENT CABINET SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Musical instrument cabinet system.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Design system of storage cabinets for musical instruments which will be chip and abrasion resistant under normal usage and will protect instruments and cases from damage under normal use.
  - 2. Design shelving to withstand continuous use without surface or front edge breakdown.
  - 3. Performance Requirements: Full height door to support a minimum vertical live load of 315 lb., applied at outer edge.

1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES.
- B. Product Data: Submit applicable reference standards, performance data and application recommendations.
- C. Shop Drawings: Submit design and installation drawings showing product components in assembly with adjacent materials and products.
- D. Quality Control Submittals: Manufacturer's installation instructions.
- E. Contract Closeout Submittals:
  - 1. Maintenance recommendations.
  - 2. Warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Pack and ship to avoid damage according to manufacturer's recommendations:
  - 1. Finish and assemble components in factory before shipment.
  - 2. Ship components in individual, sealed, labeled cartons.
  - 3. Deliver components to room designated for installation.
- B. Do not accept or install damaged products at the site.
- C. Store products in heated, indoor storage near point of installation. Retain protective packaging until installing.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements: Do not install cabinets until mortar, wet and dust-producing work is completed.
- B. Field Measurements: Obtain required field measurements from the Contractor and indicate on Shop Drawings.

1.6 WARRANTY

- A. Provide manufacturer's written warranty that products not in accordance with requirements of Contract Documents within 10 years after commencement of warranties shall be corrected promptly.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Wenger Corporation (phone 800.733.0393 web site: [www.wengercorp.com](http://www.wengercorp.com)).

### 2.2 MATERIALS

- A. Cabinet Wall Panels: 3/4" thick industrial (cabinet) grade particleboard, minimum 48 pcf with thermoset polyester laminate on both sides, color - As selected by Architect from manufacturer's standard colors.
- B. Cabinet Shelving:
1. Cabinets up to 27" wide: One-piece high molecular blow-molded polyethylene with 1 3/8 " radius front edge (Patented). Mount to cabinet walls with one-piece molded rigid PVC clip.
  2. Cabinets over 27" wide: One-piece high molecular formed polyethylene with radius front edge and 3/16" wall thickness. Ribbed for structural integrity. Supported by four structural tubular members 1 1/2" x 1" x 16 ga. wall thickness with 14 gauge welded end plates.
- C. **Grille doors: Welded steel grille construction with powder coat finish, color - As selected by Architect from manufacturer's standard colors.**
1. Hinges: 5-knuckle institutional type, supplied by ISO 9002 vendor. Hinge will support 315 lbs. dynamic vertical load. Hinge pin shall be 2 3/4" long. Hinge welded to door frame in five places. Hinge fastened to cabinet with through-bolt construction. Powder paint color as selected by Architect. Two hinges on compartment doors; four on full height doors.
  2. Locking slide-bolt designed for padlocks, with strike plate: 14 gauge steel; provide clear plastic label holder for identification card insert. Finish: Powder paint coating, color as selected by Architect.
- D. Edging: Heat bonded 3mm beveled PVC edge-banding, color - As selected by Architect from manufacturer's standard colors.
- E. Finish Hardware:
1. Joinery Hardware: 2", 1/4-20 panel connectors with 15mm head diameter, and steel thread inserts. Finish: Powder paint coating, color - oyster.
  2. Cabinet levelers: Four leveling glides within minimum 3/8" diameter threaded rod in steel corner brackets, six glides for cabinets with divider panels.
- F. Cabinet Back Panel: 1/4" thick prefinished hardboard, color oyster to match interior of side and top panels.
- G. **Folio Cabinets: Contain four 2 3/8" swivel casters, adjustable tempered hardboard shelves and lockable doors. Cabinet color: Oyster. Door color: As selected by Architect from manufacturer's standard colors.**
- H. **String Instrument Racks: Contain four 2 1/2" swivel casters, upholstered cross supports (except for violin rack), pegs for bow storage. Color: As selected by Architect from manufacturer's standard colors.**

### 2.3 MANUFACTURED UNITS

- A. Fabricate and package components in the factory and ship fully-assembled or ready-to-assemble.
- B. Sheet Music Folio Storage Casework
1. Wall panels are 3/4" thick industrial grade composite wood with no added formaldehyde and polyester laminate finish.
  2. Shelves are 1/8" thick tempered hardboard.
  3. Shelf support columns are extruded aluminum, black powder-coat paint finish.
  4. Cabinet includes four levelers to level and square cabinet.
  5. Number strips included for all shelf spacing options.
  6. Cabinets are shipped fully assembled.
  7. Include wall mounting bracket.
  8. **Castors: 4 rigid 8 inch diameter casters.**
  9. Casework Panel Color: As selected by Architect from manufacturer's standard colors.

C. Music Library System (7-Shelf Unit):

1. Pull-out design, equally spaced shelves provide 10-1/2" of available height per shelf.
2. Standard width units have 12" x 34-1/2" x 10-1/2" of shelf space available.
3. Four shelves are adjustable and three shelves are fixed. The upper fixed shelf can be repositioned in five different locations for greater flexibility.
4. Units are constructed of 3/4" thick industrial grade composite wood with no ureaadded formaldehyde added, 3/4 inch thick. and polyester laminate finish.
5. Shelves are reinforced with an aluminum extrusion that includes a slot with vinyl material for labeling with dry-erase markers.
6. Frame is 16-gauge, 1" square tubular steel, painted black.
7. Back panel is designed to fit on either side of unit for left or right hand use.
8. Provide four 8"-diameter casters for easy movement of unit.
9. Provide Model 173G011 End cover in Oyster.
10. Each unit shall contain bumpers for control of side and outward movement.
11. Anchor entire assembly to floor and wall.
12. Weight Capacities:
  - a. Each shelf is rated at 100 lbs. maximum capacity.
  - b. 7-shelf unit with = 700 lbs. total unit capacity
13. Sheet Music Capacity (approximate):
  - a. 7-shelf unit = 190 titles at 1-1/4 adjustable and 3 fixed shelves, with metal book supports" spacing per title.
  - b. 240 titles at 1" spacing.
  - c. 300 titles at 3/4" spacing.
14. Exposed End Cover Panels: Particleboard thermoset panel with no urea formaldehyde added, 3/4 inch thick.
15. Casework Panel Color: As selected by Architect from manufacturer's standard colors.
16. Top Closures must be used if installing less than four Shelf Units. Provide model 173G012 Top closure, constructed particleboard that matches the end covers

2.4 OPTIONS REQUIRED

- A. Vertical Closure Kit: Provide visual closure between wall and cabinet. Constructed of .750" thick thermoset composite wood to match cabinet side panels. Color: oyster. Will fit 3/4" to 30" wide opening; provide as required.
- B. Top Back Filler Kit: Provide visual closure between back wall and top panel of cabinet. Constructed of .750" thick thermoset composite wood to match cabinet top panels. Color: Oyster. Will fit 10" and 20" deep openings.

2.5 METAL SHELVING SYSTEMS

- A. GearBoss Metal Shelving Systems, Shelf Starter Bay, Shelf Add-On Bay, and Shelves by Wenger Corporation: Cantilever-type modular metal storage shelving system comprised of the following components:
  1. Structural Performance:
    - a. Allowable Load Rating: 1000 lb. (373 kg) per 4 by 8-foot (1219 by 2438-mm) bay.
    - b. Load-Carrying Capacity per 48 inch (1219 mm) Shelf: 250 lb. (113 kg).
  2. Shelf Unit Uprights: Steel tube, metallic-coated, 2-inch (50.8 mm) square, 0.109-inch (2.76 mm) thick, with perforations on all four sides at 1 inch (25 mm) on center.
  3. Horizontal Stringer: Formed sheet steel, metallic-coated, 0.075-inch (1.9-mm) thick.
  4. Shelf Cross Tubes: 14 gauge steel tube, metallic-coated, 5/8-inch (22-mm) square.
  5. Shelf Brackets: Formed steel, 0.015-inch (0.38-mm) thick.
  6. Laminate-Clad Wood Panels: Core material and thickness indicated, finished with thermally-fused anti-microbial polyester surfacing on both sides.
  7. Unit Width: 48 inch (1219 mm) center-to-center unless otherwise indicated.
  8. Unit Height: As indicated on the Drawings.
  9. Shelves can be adjusted in 1 inch (25 mm) increment without tools.
- B. Metal Shelving Materials:
  1. Aluminum Extruded Bars, Profiles, and Tubes: ASTM B221.
  2. Sheet Steel: Cold-rolled, ASTM A1008, commercial steel, type B.
  3. Steel Tube: ASTM A501, hot-formed steel tubing.
  4. Steel Wire: ASTM C510, cold drawn steel wire.

5. Particleboard: To ANSI A208.1, minimum 43 lb/cu. ft. (689 kg/cu. m) density.
    - a. Provide fire retardant treated type.
  6. Plywood: APA standards PS1-98 section 5.7.4 or 5.7.1 or ANSI /HPVA HP-1-2004 Panel provide with HDF skins to prevent grain telegraphing.
    - a. Provide fire retardant treated type.
  7. Steel Tube: ASTM A500, cold-formed steel tubing.
  8. Laminate Finish: Composite, of thickness indicated, finished with thermally-fused anti-microbial polyester surfacing on both sides, meeting performance properties of NEMA LD3 for VGS grade, with heat bonded, radiused, 3 mm thick extruded PVC edge banding.
    - a. Surface Abrasion Resistance: Taber Wheel, 400 cycles, for solid colors.
  9. PVC Edge Banding: LMA EDG-1, radiused PVC extrusions, 3 mm thick, heat-bonded.
  10. Anchors and Fasteners:
    - a. Factory Provided: Material, type, and size recommended by manufacturer for secure anchorage to substrate.
    - b. Field Installed: Manufacturer-recommended fasteners furnished by Contractor as required for locker substrate and project requirements.
- C. Metal Shelving Fabrication:
1. Fabricate components square, and rigid. Make exposed metal safe to touch and free of sharp ends or burrs.
  2. Form frames, panels, doors, and accessories from one-piece, or one rigid assembly, unless specifically shown on Shop Drawings.
  3. Factory preassemble metal components by welding all joints, and connections; with no bolts, nuts, screws, or rivets used in assembly, except as required for knock down shipping and attachment to mounting surfaces.
- D. Metal Shelving Accessories:
1. Shelf Depth: 30.5 inches (775 mm) with 4 cross tubes.
- E. Metal Shelving Finishes: Manufacturer's standard finish, color as selected by Architect from manufacturer's standard colors.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust hardware for smooth operation.
- B. Clean surfaces of soil.
- C. Remove packaging materials and construction debris.

### 3.3 SCHEDULE

- A. Cabinet types as scheduled; refer to Drawings.

END OF SECTION



SECTION 12 36 61.19

QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Quartz surfacing for countertops.
- B. Related Sections:
  - 1. Section 06 40 00 - Architectural Woodwork.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit manufacturer's product data and fabrication and installation instructions.
- C. Shop Drawings: Show field-verified dimensions, quartz surfacing dimensions, locations and dimensions of cutouts, required locations of support and blocking members, edge profiles, and installation details and methods.
- D. Samples: Submit two 6" x 6" sets of manufacturer's standard colors and finishes.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Packaging, Shipping, Handling, and Unloading: Observe manufacturer's recommendations and handle in manner to prevent breakage or damage. Brace parts if necessary. Transport in the near-vertical position with finished face toward finished face. Do not allow finished surfaces to rub during shipping or handling.
- B. Storage and Protection: Store in racks in near-vertical position. Prevent warpage and breakage. Store inside away from direct exposure to sun. Store between 25°F. and 130°F. Store with finished face toward finished face.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Quartz as manufactured by Cambria; phone 833-226-2742; web site: [www.cambriausacom](http://www.cambriausacom)) and as scheduled; reference Material Finish Schedule in drawings, or an equivalent product approved by Architect.

2.2 QUARTZ SURFACING

- A. Composition: 93 percent crushed quartz aggregate combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
- B. Thickness: Nominal 1-1/4 inches.
- C. Color and Finish: Provide colors and finishes selected by Architect from manufacturer's stocked standards.

2.3 ACCESSORIES

- A. Mounting Adhesives: Provide structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use.
- B. Solvent: Product recommended by adhesive manufacturer to clean surface of quartz surfacing to assure adhesion of adhesives.
- C. Cleaning Agents: Non-abrasive, soft-scrub type kitchen cleansers.

## 2.4 FABRICATION

- A. Fabricator: Firm shall have five years experience fabricating architectural stone and shall have water-cooled cutting tools.
- B. Shop Assembly: Observe proper safety procedures and comply with manufacturer's instructions.
- C. Layout: Layout joints to minimize joints and to avoid L-shaped pieces of quartz surfacing.
- D. Inspect Material:
  - 1. Inspect material for defects prior to fabrication.
  - 2. Color Match: Materials throughout project shall be from the same batch and shall bear labels with same batch number. Visually inspect materials to be used for adjacent pieces to assure acceptable color match. Inspect in lighting conditions similar to those on project.
  - 3. Variation in distribution of aggregates in quartz surfacing which are within manufacturer's tolerances is not a defect.
- E. Tools: Cut and polish with water-cooled power tools.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site Verification:
  - 1. Verify dimensions by field measurements prior to fabrication.
  - 2. Verify that substrates supporting quartz surfaces are plumb, level, and flat to within 1/16 inch in ten feet and that necessary supports and blocking are in place.
- B. Inspect finished surfaces for damage. Do not install until damage materials have been repaired in an acceptable manner or replaced.

### 3.2 INSTALLATION

- A. Install materials in accordance to manufacturer's written instructions and recommendations. Lift and place to avoid breakage.
- B. Preliminary Installation and Adjustment: Position materials to verify that materials are correctly sized and prepared. Make necessary adjustments.
  - 1. If jobsite cutting, grinding, or polishing is required, use water-cooled tools. Protect jobsite and surfaces against dust and water. Perform work away from installation site if possible.
  - 2. Allow gaps for expansion of not less than 1/16 inch per five feet when installed between walls or other fixed conditions.
- C. Permanent Installation:
  - 1. After verifying fit, remove quartz surfacing from position, clean substrates of dust and contamination, and clean quartz surfacing back side and joints with solvent.
  - 2. Apply sufficient quantity of mounting adhesive in accordance with adhesive manufacturer's recommendations to provide permanent, secure installation.
  - 3. Install surfacing plumb, level, and square and flat to within 1/16 inch in ten feet.
- D. Joints Between Adjacent Pieces of Quartz Surfacing:
  - 1. Joints shall be flush, tight fitting, level, and neat.
  - 2. Securely join with stone adhesive. Fill joints level with quartz surfacing.
  - 3. Clamp or brace quartz surfacing in position until adhesive sets.

### 3.3 REPAIR

- A. Repair or replace damaged materials in a satisfactory manner.

### 3.4 CLEANING AND PROTECTION

- A. Remove masking and excess adhesives and sealants. Clean exposed surfaces.

B. Protect surfacing from damage by other trades.

END OF SECTION

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SECTION 13 21 48

SOUND-CONDITIONED ROOMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish and install modular sound-isolating enclosures; Standard module non-upgradeable to VAE, including:
  - a. Perimeter neoprene floor seal
  - b. Door with vision light
  - c. Corner posts with integrated speakers enclosures and wiring
  - d. Wall panels with integrated wiring and mountings for microphones
  - e. Ceiling frame
  - f. Ceiling panels
  - g. Integrated ventilation, illumination, system control and power and signal distribution systems
  - h. Access raceways for signal distribution systems (i.e. smoke detectors, intercom, warning devices, etc.).

B. Related Sections:

1. Section 08 71 00 - Door Hardware; locksets.
2. Division 23- Directly connected HVAC system.
3. Division 26 - Electrical.

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Modular, sound-isolating enclosures with internal acoustical environments suitable for music instruction and rehearsal, voice announcements and tape recording, private consultations and testimony, and remedial instruction; modular in 15" increments; individual panels removable and replaceable with only partial disassembly of module. Modules shall have integrated wiring, speaker enclosures and microphones mounts to allow for upgrade of room to V-Room® Practice without disassembly. Modules shall be easily demountable and relocated without loss of effectiveness. Wall and ceiling panels will meet Underwriters Laboratory (UL) Class 1 classification per U.L. Standard 723 for flame spread and smoke developed. Modules shall seal to any floor without being physically attached or with the use of caulking, interior height of standard room is 7'-5-3/4".

B. Performance Requirements: Current production units with 410 cubic foot interior volume, 34% perforated interior panels, 12-inch airspace between modules, concrete floor construction:

1. Airborne Noise Reduction: Sound-isolation practice rooms with 410 cu. ft. (11.6 cu. m) interior volume, 34 percent perforated interior panels, 12 inch (304 mm) airspace between modules, mounted on concrete floor construction, tested as follows:

- a. NIC 41 from exterior to interior of module, per independent lab test.
- b. NIC 63 from interior of one module to interior of adjacent module, with 12 inches (304 mm) airspace between modules, per independent lab test.

2. Ambient noise at center of module, lighting and ventilating systems operating: Not exceeding NC 25.

3. Reverberation time in contiguous octave bands, center frequencies from 125 to 4000 Hz: 0.45 plus or minus 0.1 second (based on a 640 cu. ft. interior volume).

4. Sound absorption coefficients of perforated wall and ceiling panels:

One-third Octave Band Center Frequency (Hz)	Absorption Coefficient (Sabins/sq. ft.)
125	0.57
250	0.98
500	1.13
1000	1.06
2000	1.06
4000	1.03

5. Lighting level: 80 foot-candles at 36" above floor at module center.

6. Ventilation system: 50 air changes per hour.

### 1.3 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data:
  - 1. Submit applicable documentation showing compliance with reference standards, current performance data, and application recommendations and product limitations.
- C. Shop Drawings:
  - 1. Submit assembly and installation drawings showing product components in assembly with adjacent materials and products.
- D. Samples: Submit sample model of systems showing materials, configuration, construction features, framework, finish, and hardware.
- E. Test Data: Where required, submit test data from independent testing agencies demonstrating compliance with structural or performance standards.

### 1.4 QUALITY ASSURANCE

- A. Installer's Qualifications: Installation, disassembly and reassembly shall be by the manufacturer or shall be under the direct supervision of the manufacturer.
- B. Electrical Components: Listed and labeled per NFPA 70, Article 100 by a testing agency acceptable to Authorities Having Jurisdiction (AHJ).
- C. Regulatory Requirements: Comply with the U.S. Architectural and Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack and ship to avoid damage according to manufacturer's recommendations:
  - 1. Finish and assemble all components in the factory before shipment.
  - 2. Ship components in individual, sealed, labeled cartons.
  - 3. Deliver components to room designated for installation.
- B. Do not accept damaged products at the site. Do not install damaged products.
- C. Store products in heated indoor storage near point of installation. Retain protective packaging unit installing.

### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Obtain field measurements from Contractor or by job site visit and indicate on shop drawings.
- B. Environmental Requirements: Do not install modules until all mortar, wet and dust producing trades have completed their work and finish floor is in place.

### 1.7 WARRANTY

- A. Provide written warranty that products found to be not in accordance with the requirements of the contract documents within a period of 5 years after date of commencement of warranties shall be corrected promptly after receipt of written notice from Owner.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: SoundLok Sound-Isolating Practice Rooms as manufactured by Wenger Corporation (phone 800.733.0393 web site: [www.wengercorp.com](http://www.wengercorp.com)). Factory-fabricated, modular, sound-isolation enclosures with sound transmission characteristics meeting requirements. Enclosures shall be internally wired for power, lighting, and ventilation controls. Site-fabricated enclosures and enclosures with site-installed gaskets and sealants shall not be allowed. Modifications to room on site affect acoustical performance and laboratory test data.
  - 1. Rooms shall be assembled from factory-gasketed modular components that allow reconfiguration and relocation without component modification or loss of acoustical performance.
- B. Room Variation: Sound-isolation practice rooms (non-upgradeable to VAE) shall be standard room that does NOT have the ability to be upgraded to the VAE technology system.

### 2.2 STANDARD MANUFACTURED COMPONENTS

- A. Wall Frame: 14 gauge steel channel with 1-1/4" thick neoprene pad adjustable plus or minus 3/8" to provide seal at floor and to compensate for 3/4" maximum variation in floor surface. Frame shall not lag, bolt or screw into building floor surface.
- B. Wall Panels: 15" x 30" wide and 4" thick; exterior face 16 gauge steel; interior face 22 gauge perforated or solid steel; filled with sound absorbing material; acoustical seal by two continuous Isoloss™ gaskets at perimeter of each panel; alignment and compression seal between panels by mechanical locks. Integrated microphone mounts and wiring located behind perforated wall panels (2 per room). Forced fit, "H" member of friction fit panels not allowed.
- C. Door Panel: Out-swinging pre-hung 36" door in frame; 2" thick; exterior face - 16 gauge steel; interior face - 14 gauge steel; filled with sound-absorbing material; 24" x 76" vision light glazed with 1/4" and 3/16" panes of laminated safety glass, 2" air space; frame - 16 gauge tubular steel filled with sound-absorbing material; 16 gauge door insert panels; double acoustical seal-magnetic and compression seal at head and jams, adjustable sweep seal at bottom; hardware - ramped metal threshold, continuous hinge, and bumper. (Door is STC 46)
  - 1. Safety Glazing Products: 16 CFR 1201.
  - 2. Keying: Interchangeable core, with cylinder specified in SECTION 08 71 00 - DOOR HARDWARE.
- D. Corner Assembly: Same construction as wall panels. 11-1/2" wide on each outside face. Exterior face 16 gauge steel; interior face 22 gauge perforated steel. Filled with sound absorbing material; acoustical seal by two continuous Isoloss™ gaskets at perimeter of each panel; alignment and compression seal between panels by mechanical locks. Integrated speaker enclosures and wiring in each corner assembly.
- E. Ceiling Frame: Sheet steel, 16-gauge/0.053 inch thick, with clamping mechanism for compressing ceiling panel acoustical gaskets, with external support beam where required by room size.
- F. Ceiling Panels: 15" wide and 6" thick same construction as wall panels. Ceiling spans greater than 105" require center support beam.
  - 1. Sprinkler Ceiling Panels: Where indicated, panels fabricated with predrilled holes to enable fire sprinkler system installation specified elsewhere. Furnish covers for installations not requiring sprinkler piping penetration.
- G. Light Panels: Same construction as ceiling panels; Light Panels: Where indicated, highly efficient, 50/60Hz, 100-277 Volt AC, 40 Watt, 1'x 4' dimmable edge-lit LED flat panels. Technical information; power factor: 0.9, lifetime (L70): 50,000 hours, LED chip type: 2835, number of LEDs (per panel): 216, physical dimensions: 11.83 inches (W) x 47.63 inches (L) x 0.39 inches (H), color temperature: 5000k (standard), lumens: 4200, beam angle: 120 degrees, RA value: 80, compatible with 0-10V dimmers. Compliance and approvals: ETL, FCC, DLC QPL, IP rating: damp locations; provide thermal overload protection; 12-foot power cord.
- H. Vent Panel: 15" wide by 6" thick for intake air through acoustical plenum with 1-1/2" sound-absorbing duct liner and four 90 degree bends; number of vent panels equal to number of fan panels.
- I. Fan panel (non-direct connect HVAC systems): Same construction as vent panel with six 90 degree bends; to include 230 cfm exhaust fan; accessible from module interior; 12-foot power cord.

- J. Light/Vent Panels (direct connected HVAC systems): Ceiling vent panel 15" wide by 6" thick for intake air through acoustical plenum with 1-1/2" sound-absorbing duct liner and four 90 degree bends; 8" round duct connection; use only flex duct for connection (to maintain sound isolation); provide fluorescent luminaries with sound level "A" rated.
- K. Power Panel: Same construction as wall panels, prewired according to N.E.C. (National Electric Code) (local requirements if export Module); wiring devices to bear state electrical inspector's seal visible by removing electrical box cover plate; junction and electrical boxes with airtight cover plates; interior - one four-plex receptacles, toggle switches labeled "LIGHT" "AIR" and "SYSTEM" to control luminare, fan and future V-Room® Practice active acoustics; two four-plex boxes located 8" from the ceiling with two double cover plates for connections for alarms, warning devices, smoke detectors, etc.; exterior - three four-plex receptacles; signal wiring raceway through 30" length 3/4" of conduit dropping vertically between exterior and interior junction boxes; 20-foot power cord. Integrated wiring and access plate for future upgrade to V-Room® Practice. Electrical components shall be UL/CSA listed.
- L. Finishes:
  - 1. Hardware and Electrical Cover Plates: Satin chrome.
  - 2. All Other Components: Iron phosphate precoat and epoxy powder thermoset (baked) finish; colors: oyster wall and ceiling panels with charcoal trim
  - 3. Door insert panel color(s) as selected by Architect.
  - 4. Air dry finish not allowed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Confirm that substrate floor is flat within 1/4" measured from a 10-foot straight-edge (American Concrete Institute Class C tolerance).

### 3.2 INSTALLATION

- A. Manufacturer install modules or directly supervise installation.
- B. Assemble and install modules without the use of caulking or other wet sealants, fillers, insulation, rivets or sheet metal screws.
- C. All components are manufactured units, prewired where appropriate. Field modification, cutting, fitting and wiring are prohibited.

### 3.3 CLEANING

- A. Appointed installer shall clean all surfaces according to manufacturer's recommendations.
- B. Manufacturer's installer shall remove all packing materials and construction debris from site.

END OF SECTION



## SECTION 13 34 13

### GREENHOUSE

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes: Pre-engineered greenhouse including the substructure, aluminum framing, vents, doors, polycarbonate panels, control wiring, trim and accessories as required by the drawings.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-in-place Concrete: concrete foundation.
  - 2. Section 31 23 00- Excavation and Fill.
  - 3. Section 33 41 16 - Polyvinyl Chloride Storm Utility Drainage Piping.
  - 4. Division 22 - Plumbing service.
  - 5. Division 26 - Electrical service.

##### 1.2 SUBMITTALS

- A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include complete erection drawings showing structural system, panel layout, equipment and controls.
- B. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit a 12" long by actual width sample of polycarbonate panels.

##### 1.3 QUALITY ASSURANCE

- A. Design Criteria:
  - 1. Design Loads: Allowable stress: Structure shall be designed to carry the following loads:
    - a. Dead load of structure, plus appurtenances: minimum 3 pounds per square foot.
    - b. Live Load: 15 pounds per square foot on vertically projected surfaces.
    - c. The above loads shall be considered to act in the following combinations:
      - 1) Dead load plus live load.
      - 2) Dead load plus wind load plus half live load.
      - 3) Specification of UBC and/or wind and seismic loading may take precedence as required.
- B. Installation of the pre-engineered greenhouse shall be performed by one of the following:
  - 1. Authorized builder or contractor of the manufacturer having a minimum of five years experience in installations of this type.
  - 2. Contractor authorized by the manufacturer as trained and qualified to erect the manufacturer's product and have a minimum of five years experience in installations of this type.
- C. Manufacturer's Qualifications: Provide pre-engineered greenhouse as produced by a manufacturer with not less than 5 years successful experience in the fabrication of pre-engineered greenhouse of the type and quality required.

##### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver framing members, panels and trim items to the project site with no dents, scratches, or abraded areas. Deliver in manufacturer's standard bundles, securely bound and store at the project site raised above slab or ground level on pallets.

##### 1.5 WARRANTY

- A. Greenhouse shall be warranted free from defects under normal use and conditions for 5 years from date of delivery. Warranty does not cover labor charges for replacement or repairs. Products sold by but not manufactured by greenhouse company are warranted to the extent of the original manufacturers' warranties.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE PRODUCTS/MANUFACTURERS

- A. An American Classic 2500 Series, pre-engineered truss design, free standing, full span greenhouse (no center posts) manufactured by Texas Greenhouse Company, Inc., Fort Worth, TX. (phone 800.227.5447 web site: [www.texasgreenhouse.com](http://www.texasgreenhouse.com))
1. ACG-2550/32" American Classic Gardener Free Standing Greenhouse in mill finish aluminum, a galvanized steel substructure, designed to be installed on a 32" high kneewall, covered in 6mm clear twin wall polycarbonate.
    - a. Two continuous ridge vents and one 36" x 24' 10½" end pad vent.
    - b. One 36" x 80" heavy duty aluminum commercial store front type door with 1½ pair butts, closures, thumb locks, push pull hardware and glazed with ¼" clear tempered glass at one side wall.
    - c. One set of double 32" x 80" doors of the same type at one gable end.
    - d. The sidewall height of the greenhouse will be just tall enough to accommodate the doors to be located at the bottom of the curve. (80¼" from finished floor to door header).
    - e. Approximate Dimensions: 24'-10½" wide x 72'-0" long x 17'-7½" high from finished floor grade. Reference drawings.
  2. Climate control package including the following systems with a complete description. The design of the following equipment is based upon a 45° temperature differential between inside and outside temperatures, 5,000 ft. candles of light and a 7° pad to fan rise in temperature.
    - a. Cooling System:
      - 2 - DC30F Windmaster Fan with slant wall housing/guard, 1-speed, 115V
      - 2 - WA3333 Windmaster Fan Shutters
      - 36" Kool Cel Pads (4" x 12" x 36")
      - 1 - 25' Aluminum Distribution and Return System, includes PVC pipe distributors and pad cover, return gutter and necessary connectors and fittings.
      - 1 - Plumbing Completer package containing necessary fittings, valves, strainers, float valve and PVC pipe to complete the system.
      - 1 - #15S Submersible pumps
      - 1 - 36" x 24' 10½" Automatic Pad Vent by T.G.C.I. (included with greenhouse)
      - 1 - Sump Tank, approximately 105 gallon capacity.
    - b. Heat Distribution and Ventilation System:
      - 1 - RC24F Fan Jet, 115V
      - 1 - WAC3333 Wall Shutter for Fan Jet
      - 1 - MKCAM Motorizing Kit for wall shutter
      - 1 - HT24 Heat Accessory Kit
      - 1 - 24" x 100' Roll of Polytube, Punched "HKP"
      - 1 - Tube Wire support package, 50'
      - 1 - Tube Hanger and Snap Ring Package for hanging polytube
    - c. Heaters:
      - 2 - PAE100 Modine Natural Gas Heaters
      - 2 - Sets stacks for venting heaters through end of greenhouse
    - d. Control System: 1 - Wadsworth Stop 50A Climate Controller, with relays
  3. Shading Device:
    - a. 1 - Set Shade Fabric Panels (47%) with taped and grommeted edges for easy attachment. Vent Pos., 4'8" x 50'6", 2 side Pos. 15'8" x 50'6", includes ¼" aluminum rods
  4. Potting Benches.
    - 1 - 36" x 48' Attached Benches with galvanized mesh bench tops
    - 1 - 36" x 36' Attached Benches with galvanized mesh bench tops
    - 4 - 48" x 12' Free Standing Galvanized Steel Benches with poly bench tops
    - 2 - 48" x 10' Free Standing Galvanized Steel Benches with poly bench tops
  5. Installation of greenhouse and accessories includes control wiring for the items listed in this proposal, from a panel provided by others.

### 2.2 STRUCTURE AND DESIGN

- A. Steel Substructure: Consists of side posts, roof chords and trussing, of hot dipped galvanized steel. Steel rib truss sections to be no greater than 8'-5¼" on centers.

- B. Aluminum Framing Members: Special aluminum extrusions consisting of sills, purlins, ridge and vent members, and curved glazing bars with a 24" radius. Manufactured of 6063-T6 Alloy. Curved glazing bars are on 24¼" centers and are continual from center ridge to foundation without need for exterior rain gutters.
  - 1. Make adequate provisions during fabrication depending on length of structure for expansion and contraction of aluminum.
  - 2. Sill shall be specially designed aluminum extrusion permitting horizontal security and vertical adjustment.
- C. Two Full Length Vents: Furnished as standard equipment on each side of the ridge and designed with a continuous non-wearing ball and socket type hinge that shall not require lubrication and cannot be unseated in high winds.
  - 1. Each vent shall be operated from a manual chain vent machine with a self-lubricating sealed gear box.
  - 2. Design will permit easy automation of vents at a later time if desired.
- D. Doors: A minimum of 1¾" thick, of heavy gauge aluminum, pre-hung, commercial storefront type with 1½ pair butts, closer and thumb lock, push pull hardware and glazed with ¼" clear tempered glass.
  - 1. Gable End Doors shall be 36" x 80" double doors.
  - 2. Side Wall Doors shall be 36" x 80" single door.
- E. Panels: Secured with stainless steel clip, hex screws and horizontal holddown clips at the purlins located at top and bottom of curve, that hold panels in place without need for bar caps and permit easy pane replacement if necessary.

## 2.3 MATERIALS

- A. Framing:
  - 1. Steel rib truss sections shall be steel channel roof chords with steel channel side posts.
  - 2. Gusset plates shall be ¾" plate.
  - 3. Base plates welded to side posts shall be ¾" plate. Weld foot assembly prior to galvanizing. Foot assembly shall be bolted to side post of substructure.
  - 4. Foundation bolts shall be determined by local authorities; expansion bolts are permissible rather than anchor bolts poured in place.
- B. Sill Assembly: Aluminum extrusion approximately 2.47" x 2" and weighing .79 pounds per foot.
- C. Purlins: Aluminum extrusion designed for greenhouse use, 3-9/16" channel weighing approximately .918 pounds per lineal foot.
- D. Center Ridge: Aluminum extrusion approximately 4½" and weighing .918 pounds per foot and incorporating sockets on both sides for receiving top hinge rails of the roof vents.
- E. Glazing Bars: Aluminum extrusions approximately 1½" x 1¼" and weighing .3 pounds per foot.
- F. Door Frames: Aluminum hollow extrusion tube of 1¾" x 3" capable of carrying heavier storefront style doors if required.
- G. Hardware: Bolts, screws, nuts, etc. used in the construction of the greenhouse to be galvanized, stainless steel or aluminum as required.
- H. Glazing: 6mm Twin-wall rigid polycarbonate panels, secured with stainless steel clips, hex screws and horizontal holddown clips at the purlins located at top and bottom of curve, that hold panels in place without need for caps and permit easy panel replacement if necessary. Caulk shall be of a color compatible with the finish of the aluminum structure.
- I. Galvanized Steel Benches: 36" wide x 10' long. Bench tops to be 1.5" x 1.5" x 10.5 ga. galvanized steel mesh and molded polyethylene structural plastic resin.

## 2.4 MECHANICAL SYSTEMS

- A. The design and selection of the equipment required for heating, cooling, ventilating and recirculation of air shall be in accordance with the practices and principles of the engineering standards set forth by the Acme Engineering and Manufacturing Corp., and the NGMA, and shall provide a standard performance of 7° pad-to-fan temperature rise, 45° inside/outside temperature differential, based upon 5,000 foot candles natural light input average. Wet wall cooling shall be 4" thick Kool Cel pads with formed aluminum guttering and distribution system, as manufactured by Acme Engineering and Manufacturing Corp.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install polycarbonate panels and related items in accordance with greenhouse manufacturer's instructions.
- B. Framing: Erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation.
- C. Thermal Insulation: Install insulation concurrently with installation of roof and wall panels in accordance with manufacturer's published directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on the underside of roof sheets, extending across the top flange of purlin members and held in place by retainer strips at each longitudinal joint of insulation, installed straight and taut. Provide thermal spacer blocks in accordance with manufacturer's recommendation.
- D. Install and secure galvanized benches, trim and related items.
- E. Upon completion of installation, test for leaks. Inspect for leaks, repair leaks and re-test sections until all sections are leak-proof.

END OF SECTION

SECTION 13 34 16.13

GRANDSTANDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grandstands.
- B. Related Sections:
  - 1. Division 03 Concrete sections for requirements pertaining to concrete foundation and slabs to receive grandstands.
  - 2. Section 32 31 13 – Chain Link Fences and Gates; chain link fencing and gates to be provided as part of the Work of this Section at ends and back of grandstands.

1.2 SUBMITTALS

- A. General: Submit in accordance with Section 01 33 23.
- B. Product Data: Submit manufacturer's descriptive product data for project.
- C. Shop Drawings: Manufacturer to submit shop drawings sealed by a registered engineer in the State of Texas and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the applicable code and relevant laws. Include drawings and schedules for type, location, quantity, and details of steel and aluminum components required.
- D. Product Sample: Submit one 18-inch seat sample.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer must have ten years of experience in the manufacture of bleachers and grandstands; welders must be AWS certified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Provide grandstands as manufactured by Southern Bleacher Co. (phone 800.433.0912 website: [www.southernbleacher.com](http://www.southernbleacher.com)).web site: [www.southernbleacher.com](http://www.southernbleacher.com)). Subject to compliance with requirements of this specification, equivalent product as manufactured by one of the following will be acceptable:
  - Outdoor Aluminum, Inc. (800-225-4249, website: [www.outdooraluminum.com](http://www.outdooraluminum.com))
  - Sturdisteel (800-433-3116, website: [www.sturdisteel.com](http://www.sturdisteel.com))

2.2 DIMENSIONS

- A. Front walkway shall be 61" wide and elevated 36".

2.3 MATERIALS

- A. All support structures shall be fabricated with ASTM A 36 steel. Shop connections shall be welded. After fabrication all steel shall be hot-dipped galvanized.
- B. Aluminum:
  - 1. Aluminum seats, riser boards, backrests, and stanchions:
    - a. Anodized: Clear anodized 204R1, AA-M10C22A31, Class II.
  - 2. Footboard Planks:
    - a. 2 each nominal 2 x 10 planks; extruded aluminum alloy, 6063-T6, Clear anodized 204R1, AA M10C22A31, Class II.
- C. Joint Sleeve Assembly: Extruded aluminum alloy, 6063-T6, mill finish.

D. Accessories:

1. Channel End Caps: Aluminum alloy, 6063-T6, clear anodized 204R1.
2. Cast End Caps: Aluminum 319 alloy, cast finish.
3. Hardware:
  - a. Bolts and Nuts: Hot-dipped galvanized.
  - b. Hold-Down Clip Assembly: Aluminum alloy 6063-T6.
  - c. Structural Hardware: Hot-dipped galvanized, ASTM A 325.
4. Enclose back and ends of grandstands with chain link fence with 3'-0" pedestrian swing gates as specified in Section 32 31 13 – Chain Link Fences and Gates.
5. Enclose front of grandstands to prevent balls, people, and other objects and animals from going under bleachers.

## 2.4 FABRICATION AND DESIGN

A. Design Load:

1. Live Load: 10 psf on gross horizontal projection.
2. Lateral Sway Load: 25 plf seat plank.
3. Perpendicular Sway Load: 10 plf seat plank.
4. Wind Load: 30 psf vertical projection.
5. Live Load of Seat and Footboard Planks: 120 plf.
6. Guardrail: 100 plf vertical and 50 plf horizontal.

B. All shop connections shall be welded; manufactured by certified welders conforming to AWS Standards.

## 2.5 GUARDRAILS

A. Guardrails shall be installed on all sides of grandstands, exit steps and exit ramp.

B. Handrails shall be 1¼" min. to 1½" max. outside diameter schedule 40 anodized aluminum pipe. All open ends of rails shall be plugged with flush type metal plugs.

C. Install two-line rail on front of grandstands. In addition, install one 2 x 6 aluminum toeboard on front of grandstand and around wheel chair area. Provide vertical rails at 4'-0" o.c. maximum.

D. Install two-line rails around pressbox landings, ends and back of grandstand. In addition to line rails install chain link fence on railings. Fencing shall be 9 gauge galvanized steel.

E. Connect fencing to rails and rail risers with aluminum tie wires. Use ¼"x ¾" tension bars to attach ends.

F. Install two-line rails on exit steps and exit ramp.

G. Railing shall be 36" above surface of front walkway. Rails shall not be less than 42" above the center of any seatboard on ends and back of grandstand.

H. Railing shall be capable of safely sustaining a horizontal thrust of 50 lbs. per linear foot applied at right angles to the top rail, and 100 lbs. per linear foot of vertical load.

I. Install tow-line rail at front of center crosswalk.

## 2.6 PRESS BOX

A. Product Description: Type II Construction

1. Press Box Support Structure: Independently supported but connected to rear of grandstand. Support Structure to be 8 feet wide x 31 feet long.
2. Press Box Dimensions: 8 feet wide x 18 feet long.
3. Electrical wiring, switches and other components per NEC Specifications.

B. Materials/Finishes

1. Press Box Support Structure:
  - a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
  - b. Shop connections are seal welds.
  - c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.

2. Press Box: All materials shall be new and shall comply with ASTM specifications.
  - a. Floor
    - 1) Floor to be INTERLOCK Aluminum Decking System, extruded aluminum alloy 6063-T6, mill finish. Attach Decking System to steel floor frame with mechanical fasteners at end of plank and at intermediate supports. (Tongue & Groove or Standard extrusion is not acceptable.)
    - 2) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-11, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville, or equal.
  - b. Wall Structure
    - 1) 4 inch x 4 inch x 11 gauge square tubing with maximum span of 14 feet on front wall and maximum span of 6 feet on back wall and 4 inch x 2 1/2 inch x 14 gauge steel "cees" with maximum spacing of 5 feet for all walls with siding. Spans greater than these require engineered calculations for design.
    - 2) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation R-11, 3 1/2 inches thick. Batt or roll as manufactured by Johns Manville or equal.
    - 3) Interior Finish
      - a) 1/2 inch vinyl coated gypsum panels, Gold Bond vinyl-surfaced Durasan- Harvest Cotton.
      - b) Cove Base: Vinyl 4 inches x .080 equal to PRO CB-35 Nubian.
    - 4) Exterior Finish
      - a) 26 gauge pre-finished R-Panel paneling as manufactured by MBCI, Signature 200 color series, or equal. Color as selected by Architect.
      - b) Wall panels are attached with #12 TEK screws - 6" O.C. at the top, midpoint and bottom of the panels.
      - c) Lap screws are placed at each end of the panels, at the intermediate supports, and at the mid point between supports (TEK #14).
      - d) All fasteners to be painted same color as exterior paneling.
  - c. Roof Structure
    - 1) 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center.
    - 2) Roof: 1/8 inch fourway steel plate roof, continuous welded seams coated with acrylic metal primer as manufactured by Coronado and 36 mils of acrylink roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on both sides of rafters with 1-1/2 inch long 1/8 inch fillet welds on 12 inch centers.
    - 3) Insulation: Poly-encapsulated Formaldehyde-free fiberglass building insulation, R-19 (minimum) 6 inches thick. Batt or roll as manufactured by Johns Manville or equal.
    - 4) Cornice: 26 gauge steel prefinished to match metal siding.
    - 5) Ceiling: 24 inch x 24 inch x 5/8 inch acoustical ceiling tile (model #- USG Fissured 560) with USG grid main tee (model # DXL24), cross tee (model # DXL 216), wall angle (model # M7), wind clips and other components as manufactured by USG, or equal.
  - d. Exterior Door(s)
    - 1) Full flush steel construction with honeycomb core. 18 gauge skin sheets. Dimensions: 3 feet 0 inches x 6 feet 8 inches. Color: As selected by Architect.
    - 2) Steel door frame (16 gauge) complete with 1/2 inch threshold and weather-stripping.
    - 3) Exterior Hardware: Reference SECTION 08 7100 - FINISH HARDWARE. Handles shall be lever type that allows operation without tight grasping or twisting of the wrist. Keyed alike locks.
    - 4) Interior Hardware: Reference SECTION 08 7100 - FINISH HARDWARE. Handle shall be panic bar that allows for opening without any grasping, twisting or turning.
  - e. Windows
    - 1) Frame: Extruded aluminum single hung, vertical sliding unit, thermal break.
    - 2) Sash: Tilt toward inside for easy cleaning.
    - 3) Glazing: Clear tempered panes.
    - 4) Dimensions of each unit: Dependent on compartment size. At interior wall locations or structural support locations the dimension between windows shall be no greater than 6 inches.
    - 5) Finish: acrylic enamel.
  - f. Work Bench
    - 1) 18 inch wide work bench constructed of 4 inch x 2 1/2 inch x 14 gauge steel, and 3/4" wood. Countertops heights shall be constructed to allow wheelchair usage at all locations.
    - 2) Plastic laminate top: Equal to Wilsonart Laminates. Finish: Color as selected by Architect. Thickness: 050
    - 3) Glue: 3M Green Contact Adhesive, or equal.
  - g. Painting: Reference SECTION 09 1000 - PAINTING.
    - 1) Surfaces: Exterior Door(s), Door Frame(s)
      - a) Primer: Applied by Door Manufacturer.
      - b) Finish: 2 coats acrylic latex semi-gloss enamel applied by press box manufacturer.

- 2) Surfaces: Exterior Siding
  - a) Primer: Applied by Siding Manufacturer.
  - b) Finish: Applied by Siding Manufacturer.
  - c) Touchup: If applicable
- 3) Surfaces: Wall and Roof Structure
  - a) Primer: DTM Industrial acrylic metal primer applied after welding, or equal.
- h. Caulking: MasterSeal NP1 – Polyurethane sealant, All temperature, UV resistant, or equal. Silicone products are not acceptable.
- i. Provide window Air Conditioning/Heating Unit.
- j. Electrical
  - 1) Submittal drawing shall indicate devices and circuitry. At a minimum provide the following devices;
    - a) (3) 120v, 20A quad receptacles equally spaced at front window, below the counter.
    - b) (3) 120v, 20A duplex receptacles equally spaced at back wall.
    - c) (2) each, dedicated 120v, 20A IG duplex receptacles (to be located in shop drawings for AV equipment rack.
    - d) (2) each, dedicated 120v, 20A duplex receptacles (to be located in shop drawings for IT equipment.
    - e) At Football Field scorers booth, provide with (1) J-box, below the floor with (1) 120v 20A circuit.
  - 2) Fixtures: Surface Mounted LED lighting design as manufactured by Lithonia Lighting, or equal. Fixtures shall be located above countertop and be maximized to full length of compartment space.
  - 3) Flush mounted N.E.C. panel to be 100 amp main circuit breaker, 120/240V, 1ph 60hz, provide with isolated ground bus. Prepared ready for service line to be connected.
  - 4) Electrical outlet(s) installed per NEC shall be standard duty. All outlets shall be recessed in wall.
  - 5) Sound, Telephone, Clock, Field Communication:
    - a) (3) 4x4 j-box with single gang ring and cover, with 3/4" conduit stub-out to below floor, equally spaced at front window, below the counter. (Adjacent to receptacles). Outlet boxes to be flush mounted into wall. Any wiring completed on-site will be responsibility of such contractor for inspections. Quantity: Three will be provided.
  - 6) Sleeves:
    - a) Provide (4) 2" Sleeves to be located through floor for AV equipment. Exact locations to be location by architect & AV/Technology consultants.
- k. Warranty: The Press Box is warranted to be free from defect in materials and workmanship in the course of manufacture. This warranty excludes any other defects resulting from abnormal use in service, accidental or intentional damage or any occurrences beyond manufacturer's control.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Grandstands shall be installed by skilled mechanics under the direction of an experienced installation superintendent.
- B. Foundations:
  - 1. Footings for grandstands shall provide sufficient bearing area at bottom to support all loads of grandstands.
  - 2. Depth and design of footings shall be as shown on structural drawings per geotechnical report.
  - 3. Slope concrete slab at 1% slope away from grandstands for drainage of water.
  - 4. All hardware for anchorage of grandstands shall be hot-dipped galvanized. Secure anchor bolts in concrete footings.
  - 5. Concrete working strength shall be as specified in Section 03 30 00 – Cast in Place Concrete but not less than working strength of 3,000 psi.
- C. Securely anchor grandstands to concrete foundations in accordance with approved shop drawings.



### 3.2 CLEANING

- A. Remove protective coverings and clean exposed surfaces, leaving them free of soil and defects. Remove cartons, crates and rubbish from the premises and leave the area broom clean.

END OF SECTION

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SECTION 21 01 00

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element.
  - 2. Contractor information.
  - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
  - 4. All parts and maintenance manuals for items of equipment.
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates).
  - 9. Control operations/equipment wiring diagrams.
  - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Completed electronic manuals will be delivered to the Owner.

PART 2 – PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".  
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

## PART 3 – EXECUTION

### 3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
  - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
  - 2. Format:
    - a. Size: 8-1/2" x 11".
    - b. Text: Manufacturer's printed data or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable.
    - c. Identity of general subject matter covered in the manual.
  - 6. Binder as specified.
- B. Content of Manual:
  - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number.
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each
      - 4) Local source of supply for parts and replacement
    - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  - 2. Product Data:
    - a. Include those sheets pertinent to the specific product
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed
      - 2) Identify data applicable to installation
      - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
  - 3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  - 4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  - 5. Copy of each warranty, bond and service contract issued.
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  - 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
  - 1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts
      - 1) Function, normal operating characteristics, and limiting conditions

- 2) Performance curves, engineering data and tests
- 3) Complete nomenclature and commercial number of replaceable parts.
- b. Operating procedures:
  - 1) Start up, break-in, routine and normal operating instructions.
  - 2) Regulation, control, stopping, shut down and emergency instructions.
  - 3) Summer and winter operating instructions.
  - 4) Special operating instructions.
- c. Maintenance procedures:
  - 1) Routine operations
  - 2) Guide to trouble-shooting.
  - 3) Disassembly, repair and reassembly.
  - 4) Alignment, adjusting and checking.
  - 5) Routine service based on operating hours.
- d. Servicing and lubrication schedule. List of lubricants required.
- e. Manufacturer's printed operating and maintenance instructions.
- f. Description of sequence of operation by control manufacturer.
- g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
  - 1) Predicted life of part subject to wear.
  - 2) Items recommended to be stocked as spare parts.
- h. As installed control diagrams by controls manufacturer.
- i. Complete equipment internal wiring diagrams.
- j. Each Contractor's coordination drawings.
- k. As installed color coded piping diagrams.
- l. Charts of valve tag number, with location and function of each valve.
- m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
- n. Other data as required under pertinent sections of the specifications.
- 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
- 4. Provide complete information for products specified in Division 21.
- 5. Provide certificates of compliance as specified in each related section.
- 6. Provide start up reports as specified in each related section.
- 7. Provide signed receipts for spare parts and material.
- 8. Provide training report and certificates.
- 9. Provide backflow preventer certified test reports.

END OF SECTION



SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department
  - 5. Texas Department of Licensing & Regulations (TDLR)
  - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.2 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.3 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.4 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

FIRE PROTECTION GENERAL PROVISIONS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's seal, name, address and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
  - 6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
  - 9. Exact location of all electrical equipment in and outside of the building.
  - 10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
  - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 12. Cloud all changes.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.



1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

FIRE PROTECTION GENERAL PROVISIONS

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
  - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
  - 1. Provide the training during the Owner's regular working day.
  - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
  - 1. Minimum of 4 hours dedicated instructor time.
  - 2. 2 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
  - 1. One copy to the Owner.
  - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
  - 1. Designation approved by Architect/Engineer.
  - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
  - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

### 3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION



SECTION 21 05 10

FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

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

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 – PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 – EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 21 05 12

FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- C. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale:  $\frac{1}{4}" = 1'-0"$ .
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
  - 1. Actual mechanical equipment and components to be furnished
  - 2. Service clearance
  - 3. Relationship to other equipment and components
  - 4. Roof drains and leader piping
  - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
  - 1. Ductwork shop drawings
  - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified or not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply", "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.



- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
  - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and address
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
  - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items which require correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a re-submittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full

responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule
  - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 05 13

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
  - 1. Motors for fire protection equipment.
  - 2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
  - 5. Pipe heat tracing.
- C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.
- D. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.
- E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 – PRODUCTS

2.1 MOTORS

- A. Provide motors for fire protection equipment manufactured by one of the following:
  - 1. Baldor Electric Company.
  - 2. Century Electric Div., Inc.
  - 3. General Electric Co.
  - 4. Louis Allis Div.; Litton Industrial Products, Inc.

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

5. Lincoln Electric
  6. Marathon Electric Mfg. Corp.
  7. Reliance Electric Co.
  8. Westinghouse Electric Corp.
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:
- C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
  2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
  3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
  4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
  5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.

## 2.2 EQUIPMENT FABRICATION

- A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

## ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

SECTION 21 05 14

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information.

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse, or abandon.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

### 3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
- C. Existing Fire Protection Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. 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 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing fire protection systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping coincident with the construction.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING FIRE PROTECTION WORK

- 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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.
- D. Fire protection piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing fire protection installation, or as specified.
- H. Existing fire protection piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

### 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing equipment in renovated areas as specified in Section 21 05 00 Fire Protection General Provisions.

END OF SECTION





SECTION 21 10 00

FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.
- B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.
- C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.
- D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.
- E. Do not exceed 52,000 square feet of building for each individual sprinkler system.
- F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20
- G. It shall be the fire protection installer's responsibility, prior to bid, to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.
- H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.
- I. Study the general, structural, electrical and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.
- J. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

FIRE SPRINKLER SYSTEMS

- A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.
- B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

### 1.3 QUALITY ASSURANCE

- A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state and federal fire authorities.
- B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.
- C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

### 1.4 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.
- B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
- C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.
- D. The drawings show the location of the water entry into building. Install all zone valves at this location. Prepare the sprinkler drawings under the work of this Section.
- E. Submit samples of all sprinkler types for approval.
- F. Provide flow rates for sprinkler system and for Inspector's Sprinkler Test Drains.

### 1.5 ACCEPTABLE MANUFACTURERS

- A. Tyco Fire Products
  - 1. Anvil
  - 2. Gem
  - 3. Central
- B. Automatic Sprinkler Company of America
- C. Potter Roemer, Inc.
- D. The Reliable Automatic Sprinkler Company
- E. Viking Corporation
- F. Victaulic Company of America
- G. Grinnell

## PART 2 - PRODUCTS

### 2.1 PIPING AND FITTINGS

- A. Above Slab Inside Building
  - 1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
  - 2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
    - a. Schedule. 40, black steel pipe joined with rolled grooved fittings.
- B. Underground within five feet of building. Provide IBR pipe, in building riser, NFPA 24, UL/FM approved. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.
- C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.
- D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance to the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.
- E. Sprinkler branch tap connections, tees, cross outlet with female threaded or grooved that requires hole drilling of main pipe is not acceptable and will not be allowed.

## 2.2 SPRINKLER HEAD

- A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.
- B. All heads shall be UL listed and FM approved, and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with "O" ring design shall not be acceptable.
- C. Exposed areas:
  - 1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
  - 2. Tyco Model B, FRB, or approved equal
- D. Sidewall applications:
  - 1. Horizontal sidewall type with brass finishes and chrome escutcheon.
  - 2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
  - 3. Tyco Model B, FRB, or approved equal.
- E. Suspended ceilings:
  - 1. Adjustable drop down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
  - 2. Color of plate, selected by Architect
  - 3. Tyco Series RFII; Series ELOC, or approved equal.
- F. Dry sprinklers heads at freezers and coolers
  - 1. Tyco Model DS-1, DS-2, or approved equal.
- G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and heavy duty mechanically fastened guards. Provide Sprinkguard "Threadguard" two-piece system threads into fire line fitting; secured with two 5/16 inch bolts and Nylock nuts. Bulb type sprinklers will not be acceptable for these locations.
  - 1. Storage rooms with exposed structure.
  - 2. Gymnasiums.
  - 3. Mechanical and Electrical rooms.
  - 4. Below exposed stairs.
  - 5. Exposed structure areas.
- H. In Elevator Machine Rooms, ensure shunt trip is incorporated into the fire alarm system as per current code requirements.

## FIRE SPRINKLER SYSTEMS

1. Acceptable Manufacturers
  - a. Reliable
  - b. Grinnell
  - c. Viking

- H. Systems serving walk-in freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer's recommendation with respect to freezer ambient temperatures expected.

## 2.3 INSPECTOR'S TEST CONNECTION

- A. Provide inspector's test connection as required by NFPA 13.
  1. Ductile iron module housing with combination sight glass, orifice and bonnet assembly
  2. UL listed
  3. Victaulic No. 718
  4. Tyco or approved equal
- B. Do not terminate drain valves and test drains onto sidewalks. Pipe to designated floor sink in mechanical room or route sprinkler test drain piping to specific locations as noted on Plumbing Drawings.
- C. Provide flow rates for each Inspector's Test Drain.

## 2.4 TAMPER SWITCH / SUPERVISORY SWITCH

- A. Tamper switch on each valve
  1. Controlling or shutting off sprinkler system or any portion thereof.
  2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
  3. Switch shall be compatible with installed valve for standard mounting.
  4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

## 2.5 FLOW SWITCH

- A. Vane type flow switch.
  1. Self-contained pneumatic, adjustable retard.
  2. Two, single pole, double throw switches.
  3. Red enamel tamper proof switch housing with flow paddle.
  4. Potter Roemer Model No. 6200, or approved equal.

## 2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

## 2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

## 2.8 DRY PIPE SYSTEM

- A. General: Provide a UL listed and FM approved dry pipe system at areas subject to freezing. System shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all associated trim and piping for a complete operating system.
- B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi, supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup assembly, manufactured by Victaulic Model 756.

## FIRE SPRINKLER SYSTEMS

- C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with safety relief valve manufactured by Reliable Model A or approved equal. Size of air compressor is determined by volume of dry pipe system. Coordinate power requirement with electrical contractor. Coordinate all wiring required with Fire Alarm System.
- D. If the dry pipe system is not used in conjunction with a wet pipe system containing the necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe system at the connection to the water supply.
- E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y shall be installed in the system.
- F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.
- G. Provide an automatic or manual compressed air system capable of restoring normal air pressure to a system in 30 minutes or less.
- H. Provide an accelerator when system capacity exceeds 500 gallons.
- I. Provide a water motor alarm or electric pressure switch.
- J. Provide dry pipe valve trim and pressure gauges.
- K. Dry pipe system shall be hydraulically calculated for the hazard being protected.
- L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a heated area.
- M. Provide a test drain valve sized per NFPA. An inspector's test shall be provided at each system.
- N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.
- O. The following accessories shall be provided where required:
  - 1. Victaulic Series 756.
  - 2. Viking Model E dry pipe valve with conventional trim.
  - 3. Viking Model D-1 accelerators.

## 2.9 GASKETS

- A. Use 1/16-inch thick preformed synthetic rubber bonded.

## 2.10 COUPLINGS

- A. Use listed rolled grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

## 2.11 VALVES

- A. Use valves suitable for 175 psig WOG.
- B. Valves to be UL listed and FM approved.
- C. Valve Connections:
  - 1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
  - 2. Screwed ends for pipe sizes 2 inches and smaller.
  - 3. Flanged ends for pipe sizes 2-1/2 inches and larger.

## FIRE SPRINKLER SYSTEMS

4. Solder or screw to solder adapters for copper tubing.
  5. Use grooved body valves with mechanical grooved jointed piping.
- D. Gate Valves:
1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
  2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal by Nibco, Grinnell, Stockham and Victaulic.
- E. Check Valves:
1. Up to 2 inch, bronze, regrind bronze swing disk, solder or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
  2. Over 2 inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, or approved equal by Nibco, Grinnell, Stockham and Victaulic.
- F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.
- G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.
- H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

## 2.12 ELECTRIC ALARM BELL

- A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal.

## 2.13 GAUGES

- A. Gauges shall be bourdon tube type with minimum 4-1/2 inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.
- B. Gauges shall have 1/4 inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.
- C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.
- D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.
- E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.
- F. Manufactured by:

1. Terice Model No. 4500 Series
2. Ashcroft
3. Marsh
4. Weksler

2.14 SPARE SPRINKLER HEAD BOX

- A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

2.15 ALARM CHECK VALVE

- A. Provide UL listed check valve.
  1. Variable for City Supplied systems pressure trim set.
  2. Constant for Fire Pump Systems pressure trim set.
  3. Tyco AV-1 or approved equal by Reliable, Grinnell and Viking.

2.16 SIAMESE FIRE DEPARTMENT CONNECTION

- A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.
  1. Provide a 4" X 2-1/2" x2-1/2".
  2. Potter-Roemer #5751 or approved equal by Elkhart Brass or Reliable
- B. Siamese free standing fire department connection with chrome plated finish, local fire department thread, dust caps and chains, escutcheon, body, and 3/4 inch automatic drip marked SPRINKLER – FIRE DEPARTMENT CONNECTION.
  1. 4" X 2-1/2" 2-way

PART 3 - EXECUTION

3.1 DESIGN

- A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.
- B. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
- C. Friction losses in pipe will be based on a value of "C" = 120 in the Hazen and Williams formula.
- D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

3.2 LOCATION

- A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.
- B. Locate heads as may be required for coordinated ceiling pattern, even through number of heads exceed minimum code requirements.
- C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.

- D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" on center, minimum 6 inches and maximum 12 inches from glazing.
- E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing requiring fire exposure protection shall also utilize the Tyco window sprinklers.

### 3.3 PREPARATION

- A. Ream pipes and tubes, clean off scale, rust, oxide and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.
- B. Pipe beveled each end, per approved procedures.
- C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

### 3.4 CONNECTION

- A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.
- B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.
- C. Clamp cast iron water pipe at fittings with 3/4 inch rods and properly anchor and support.
- D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

### 3.5 COORDINATION

- A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.
- B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.
- C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

### 3.6 SURFACE CONDITIONS

- A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

### 3.7 INSTALLATION

- A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.
- B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.
- C. Locate system drains and inspector's test connections to drain to floor drain inside mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.
  - 01. Sprinkler Contractor shall note that all sprinkler test drains, in all locations, shall be routed back to the nearest mechanical room and terminated within a floor sink or trench. All valve



locations and pipe routing shall be in an accessible location. By no means shall it be acceptable for the termination to occur in other locations unless specifically noted on the MEP plans. Do not terminate drains and test drains onto sidewalks.

- D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.
- E. Locate outside alarms on wall of building and coordinate with Architect.
- F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.
- G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.
- H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings. NO FLEXIBLE SPRINKLER HEAD CONNECTORS ALLOWED.
- I. Install pipe markers to identify fire protection.
- J. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.
- K. Install fire 2-1/2 inch department valve, maximum 5 feet above floor, complying with NFPA 14.
- L. During construction, make one standpipe outlet available on each floor without delay, for fire department use.
- M. Provide 3-way standpipe outlets above roof.
- N. Provide pressure gauges at the top of each standpipe as detailed on the drawings.
- O. Provide drain for each standpipe.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.
- R. Install the complete fire sprinkler system in accordance with the approved shop drawings.
- S. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.
- T. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.
- U. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).
- V. Do not install exposed piping below structure in public area.

FIRE SPRINKLER SYSTEMS

W. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.

X. Do not intrude onto or overlap into sidewalk areas with (FDC) Fire Department Connection.

### 3.8 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved hangers per NFPA 13 connected to structural members of the building. Do not support piping from other piping or structural joist bridging. Note that saddle clamps are not allowed and not approved for supporting piping.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.

D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

### 3.9 PIPE SUPPORTS

A. Provide sprinkler piping supports per NFPA 13.

### 3.10 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:  
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.  
2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.  
1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.  
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

### 3.11 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

### 3.12 FLUSHING AND TESTING

- A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.
- B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.
- C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.
- D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

### 3.13 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

### 3.14 PIPE MARKERS

- A. Identify interior main piping and exposed in mechanical room piping with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Install identification in the following locations:
  - 1. Both sides of penetrations through walls, floors and ceilings.
  - 2. Close to valves or flanges.
  - 3. Intervals on straight pipe runs not to exceed 50 feet
  - 4. Apply marker where view is obstructed.
- C. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

### 3.15 TESTING AND ACCEPTANCE

- A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.
- B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

### 3.16 TRAINING

## FIRE SPRINKLER SYSTEMS

- A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION

SECTION 22 01 00

PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element.
  - 2. Contractor information.
  - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
  - 4. All parts and maintenance manuals for items of equipment.
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates).
  - 9. Control operations/equipment wiring diagrams.
  - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Completed electronic manuals will be delivered to the Owner.

PART 2 – PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".  
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 – EXECUTION

### 3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
  2. Format:
    - a. Size: 8-1/2" x 11".
    - b. Text: Manufacturer's printed data or neatly typewritten.
  3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable.
    - c. Identity of general subject matter covered in the manual.
  6. Binder as specified.
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number.
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer.
      - 2) Maintenance contractor as appropriate.
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement.
    - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
  3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems.
      - 2) Control and flow diagrams.
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  5. Copy of each warranty, bond and service contract issued.
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure.
      - 2) Instances that might affect validity of warranties or bonds.
  6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts.
      - 1) Function, normal operating characteristics, and limiting conditions.
      - 2) Performance curves, engineering data and tests.
      - 3) Complete nomenclature and commercial number of replaceable parts.
    - b. Operating procedures:
      - 1) Start up, break-in, routine and normal operating instructions.
      - 2) Regulation, control, stopping, shut down and emergency instructions.

- 3) Summer and winter operating instructions.
- 4) Special operating instructions.
- c. Maintenance procedures:
  - 1) Routine operations
  - 2) Guide to trouble-shooting.
  - 3) Disassembly, repair and reassembly.
  - 4) Alignment, adjusting and checking.
  - 5) Routine service based on operating hours.
- d. Servicing and lubrication schedule. List of lubricants required.
- e. Manufacturer's printed operating and maintenance instructions.
- f. Description of sequence of operation by control manufacturer.
- g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
  - 1) Predicted life of part subject to wear.
  - 2) Items recommended to be stocked as spare parts.
- h. As installed control diagrams by controls manufacturer.
- i. Complete equipment internal wiring diagrams.
- j. Each Contractor's coordination drawings.
- k. As installed color coded piping diagrams.
- l. Charts of valve tag number, with location and function of each valve.
- m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
- n. Other data as required under pertinent sections of the specifications.
- 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
- 4. Provide complete information for products specified in Division 22.
- 5. Provide certificates of compliance as specified in each related section.
- 6. Provide start up reports as specified in each related section.
- 7. Provide signed receipts for spare parts and material.
- 8. Provide training report and certificates.
- 9. Provide backflow preventer certified test reports.
- 10. Provide gas piping pressure test reports.

END OF SECTION





SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department
  - 5. Texas Department of Licensing & Regulations (TDLR)
  - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which

PLUMBING GENERAL PROVISIONS

actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's seal, name, address and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
  - 6. Indicate exact location of all underground plumbing and flow line elevation.
  - 7. Indicate exact location of all underground plumbing piping and elevation.
  - 8. Indicate exact location of all underground electrical raceways and elevations.
  - 9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
  - 12. Exact location of all electrical equipment in and outside of the building.
  - 13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
  - 14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 15. Cloud all changes.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

#### 1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

#### 1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

#### 1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

#### 1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

#### 1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

#### 1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

#### 1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

#### 1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

### PART 2 - PRODUCTS – NOT USED

### PART 3 - EXECUTION

#### 3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

### 3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
  - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

### 3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Do not use vandal resistant screws or bolts on the project.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

### 3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
  - 1. Provide the training during the Owner's regular working day.
  - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
  - 1. Minimum of 8 hours dedicated instructor time.
  - 2. 4 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
  - 1. One copy to the Owner.
  - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
  - 1. Designation approved by Architect/Engineer.
  - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
  - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

### 3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION



SECTION 22 05 10

PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

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

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 – PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 – EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION



SECTION 22 05 12

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- C. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale:  $\frac{1}{4}" = 1'-0"$ .
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
  - 1. Actual mechanical equipment and components to be furnished
  - 2. Service clearance
  - 3. Relationship to other equipment and components
  - 4. Roof drains and leader piping
  - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
  - 1. Ductwork shop drawings
  - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply, "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
  - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and address
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
  - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
  - 2. Associated items which require correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a re-submittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field

construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect/Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule
  - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor
- C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 22 05 13

ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
  - 1. Motors for plumbing equipment.
  - 2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
  - 5. Pipe heat tracing.
- C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.
- D. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.
- E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 – PRODUCTS

2.1 MOTORS

- A. Provide motors for plumbing equipment manufactured by one of the following:
  - 1. Baldor Electric Company.
  - 2. Century Electric Div., Inc.
  - 3. General Electric Co.
  - 4. Louis Allis Div.; Litton Industrial Products, Inc.
  - 5. Lincoln Electric
  - 6. Marathon Electric Mfg. Corp.
  - 7. Reliance Electric Co.
  - 8. Westinghouse Electric Corp.

ELECTRICAL PROVISIONS OF PLUMBING WORK

- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:
- C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
  - 1. Frames. NEMA #56.
  - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
  - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
  - 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
  - 5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.

## 2.2 EQUIPMENT FABRICATION

- A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 22 05 14

PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

### 3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
- C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. 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 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping coincident with the construction.



- G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.
- H. Relocate all domestic piping as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities that do not provide service to the buildings that remain.
- K. Remove existing plumbing vent penetrations through roof not to be reused. During demolition, abandoned plumbing vents are to be removed in their entirety. Do not cap the vent pipes below the roof deck and abandon in place. The hole in the roof is to be patched and made water tight.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

- 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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.
- D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.
- H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05 00 Plumbing General Provisions.

END OF SECTION

SECTION 22 05 15

PLUMBING EARTHWORK

PART 1 – GENERAL

- A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.
- B. Cut the bottom of the trench or excavation to uniform grade.
- C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.
- D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

- A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.
- B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.
- C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.

3.3 DISPOSAL OF EXCESS MATERIAL

- A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner / Architect.

END OF SECTION



SECTION 22 05 16

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
- B. Refer to Instructions to Bidders for substitution of materials and products.
- C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

- A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.
- B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Earthwork
- B. Water Distribution
- C. Sanitary Sewer
- D. Plumbing

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM) Use current edition.
  - 1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>)
  - 2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
  - 3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
  - 4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- B. City Standards
- C. Local Governing Agencies
- D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

- A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Sand: Clean, local sand
- B. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

## PART 3 – EXECUTION

### 3.1 EXCAVATION

- A. General:
  - 1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
  - 2. Sheet piling and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
  - 3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.
- B. Storm and Sanitary Sewer Trenches:
  - 1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
  - 2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.
- C. Appurtenances:
  - 1. Any overdepth excavation below appurtenances shall be refilled with compacted select fill or bank sand.
- D. Water Line Trenches:
  - 1. Water lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
  - 2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.
  - 3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

### 3.2 PIPE BEDDING AND BACKFILL – BELOW BUILDING SLAB

- A. Storm and Sanitary Sewer Trenches:
  - 1. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill consisting of bank sand or select backfill shall be placed to one foot above the top of pipe for standard earth backfill.
  - 2. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
  - 3. Backfill shall be placed in uniform layers not to exceed 8 inches loose measured depth, and compacted to a minimum of 95% of Standard Maximum Density (ASTM D698).
- B. Water Line Trenches Below Building Slab/Outside Building Slab:
  - 1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
  - 2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.

3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95% Standard Proctor.
4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8" loose depth. Each lift shall be compacted to a minimum of 90% of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.
5. Backfill, under pavement and to one foot from outer edge, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 4 above.

### 3.3 PIPE BEDDING AND BACKFILL – OUTSIDE BUILDING SLAB

- A. Storm and Sanitary Sewer Trenches:
  1. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill consisting of bank sand or select backfill shall be placed to one foot above the top of pipe for standard earth backfill.
  2. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
  3. Backfill shall be placed in uniform layers not to exceed 8 inches loose measured depth, and compacted to a minimum of 95% of Standard Maximum Density (ASTM D698).
  4. Backfill, under pavement and to one foot from outer edge, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 3 above.

### 3.4 NATURAL GAS PIPING

- A. Natural Gas Trenches:
  1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
  2. Natural gas lines shall not be installed in trenches with other utilities.
- B. Utility Locators:
  1. Provide metallic locator over all non-metallic gas piping utilities. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION





SECTION 22 05 17

PLUMBING ACCESS DOORS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 – PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock for Owner selection
- E. Prime coat finish
- F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB
- C. Acudor
- D. Elmdor

PLUMBING ACCESS DOORS

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
  - 1. 24" x 24" for plumbing multiple isolation valves and electrical related items in ceilings
  - 2. 8"x8" for plumbing for single isolation valve or shock arrestor

END OF SECTION

SECTION 22 05 19

PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 22, Plumbing
  - 1. Plumbing General Provisions
  - 2. Pipe and Pipe Fittings, General
  - 3. Valves, Strainers and Vents

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Terice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1% over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: Domestic Water 4CTSIF (Lead Free) 0-100 PSI

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.

PRESSURE AND TEMPERATURE INSTRUMENTS

- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50% into pipe.

#### 2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9" scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections (Lead Free).
- H. Accuracy: +/- 1% of scale range.
- I. Range:
  - 1. Hot water lines: 30°F to 240°F.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge (Lead Free).
- C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, storage tanks, heat exchangers.
- E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water supply and return lines.
  - 1. Hot water lines: 30°F to 240°F.
  - 2. Tempered water valves 0°F to 120°F.

END OF SECTION

SECTION 22 05 23

VALVES, STRAINERS AND VENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves
- B. Pipe strainer and suction diffusers.

PART 2 – PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
  - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
  - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
  - 3. Use grooved butterfly valves when using grooved piping.
- B. Butterfly Valves
  - 1. Butterfly valves shall conform to MSS-SP67.
  - 2. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
  - 3. All valves for domestic use must be lead free.
  - 4. Do not use Victaulic flanges on butterfly valves.
  - 5. All butterfly valves shall have a stainless steel disc.
- C. Ball Valves
  - 1. Provide ball valves with:
    - a. Blowout proof stem.
    - b. Full size port, 316 stainless steel ball and stem.
    - c. Cast bronze body.
    - d. Threaded ends.
  - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
  - 3. Service rating:
    - a. 150 psi saturated steam.
    - b. 600 psi WOG.
  - 4. Provide with memory stop for balancing valves.
  - 5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used, or as approved.
  - 6. All valves for domestic use must be lead free.
  - 7. Do not use PVC or CPVC ball valves.
- D. Valve Connections
  - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
  - 2. Thread pipe sizes 2" and smaller.
  - 3. Flange pipe sizes 2-1/2" and larger.
  - 4. Use screw to solder adapters for copper tubing.
  - 5. Use grooved body valves with mechanical grooved jointed piping.
  - 6. Use press valves when using copper press systems.
- E. Valve Operators
  - 1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
  - 2. When cocks and valves are furnished with square head stem:
    - a. Provide one wrench for every ten cocks or valves sized 2" and smaller, minimum

VALVES, STRAINERS AND VENTS

- of two.
    - b. Provide each cock or valve size 2-1/2" and larger with a wrench with setscrew.
  - 3. Where butterfly valves are provided:
    - a. Provide gear operators on valves 6" and larger.
    - b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
    - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
    - d. All butterfly valves shall have a stainless steel disc.
- F. Acceptable Manufacturers (All listed must be lead free);
  - 1. Stockham
  - 2. Dezurik
  - 3. Crane
  - 4. Nibco
  - 5. Keystone
  - 6. Jenkins
  - 7. Kitz
  - 8. Apollo
  - 9. Milwaukee Valve
- G. Check Valves:
  - 1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
  - 2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
  - 3. Acceptable Manufacturers (All listed must be lead free):
    - a. Mission Duocheck
    - b. Nibco
    - c. Keystone
    - d. Kitz
    - e. Apollo
- H. Backflow Preventer (All valves for domestic use must be lead free):
  - 1. BFP-1 (2" and smaller) bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-QT-S-LF.
  - 2. BFP-2 (2-1/2" and larger) stainless steel reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo RP4ALF-YS.
- I. Provide valves of same manufacturer throughout where possible.
- J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.
- K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.
- L. Provide valve, seat and trim materials suitable for the intended service.
- M. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, globe or ball type.
- N. Float Valve
  - 1. On – Off non-modulating action
  - 2. Fully adjustable high and low level settings

VALVES, STRAINERS AND VENTS

3. Float, float linkage and float rod
4. Complete stainless steel material
5. Level differential adjustment minimum to 18" maximum
6. Stilling well
7. Acceptable Manufacturer: CLA-VAL

## 2.2 PIPE SYSTEMS STRAINERS

- A. Body:
  1. Bronze "Y" pattern or basket as shown on the drawings.
  2. Line size.
  3. Threaded strainer blow down port.
  4. ASTM A #126 Class B Cast Iron Body.
- B. Construction:
  1. 2" size and smaller with screw connections rated 400 psi WOG.
  2. Over 2" size with flanged connections, rated 125 psi WOG.
- C. Fabricate screens of Monel or type 304 stainless steel:
  1. With 20 mesh woven wire in piping systems through 2".
  2. With 0.045 perforations in piping systems 2-1/2" and 3".
  3. With 0.125 perforations in piping systems 4" and larger.
- D. Start-up:
  1. Provide an additional fine mesh disposable screen for use during start-up operations.
  2. Remove after 30 days.
  3. Attach to piping for Owner's review.
- E. Acceptable Manufacturers (All listed must be lead free):
  1. Apollo
  2. Crane
  3. Keckley
  4. Kitz
  5. McAlear
  6. Mueller
  7. Muesco
  8. Nibco
  9. Zurn

## 2.3 VALVE SCHEDULE

- A. Domestic Service
  1. Gas shut-off service: UL approved for natural gas service.
    - a. Nibco Ball Valve, full port through 1": T-585-70-UL
    - b. Nibco Ball Valve conventional port 1-1/4" through 3": T-580-70-UL
    - c. Resun 2-1/2" and larger: 143 - 1-UL
    - d. DeZurick 2-1/2" and larger: Series 425 or 435
    - e. Locking Type: Rockford 3/4" and 1" PNP-400  
Mueller 1-1/4" through 4": Lub-O-seal
    - f. Conbraco Ball Valve, full port through 4": 64-100 Series
    - h. Milwaukee Full Port 1/4"-2" #8303A
    - i. Milwaukee Standard Port 2-1/2" & 3" #8503
    - j. Kitz Full Port 2" =- #68
    - k. Apollo
  2. Cold and Hot water service (all listed must be Lead Free):
    - a. Nibco Ball Valve full port through 2": T-585-66-LF
    - b. Nibco Butterfly Valve 2-1/2" and larger: LD-2000 EDPM Gaskets
    - c. Watts Ball Valve 4" and larger: G-4000-FDA
    - d. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
    - e. Kitz Full Port through 2" - #868M Lead Free
    - f. Milwaukee Full Port 1/4"-2" #8303A

### VALVES, STRAINERS AND VENTS

- g. Milwaukee Standard Port 2-1/2" & 3" #8503
- h. Apollo Full Port to 3-1/2" 77CALF
- i. Apollo Conventional Port 2-1/2"=3" 7OLF
- 3. Compressed air system
  - a. Nibco Ball Valve full port through 2": T-585-70-66
  - b. Nibco Ball Valve 2-1/2" and 3" conventional port: T-580-70-66
  - c. Watts Ball Valve 4" and larger: G-4000
  - d. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
- 4. Check Valve (All listed must be Lead Free):
  - a. Nibco Check Valve: T - 413 – Y -LF (Teflon Seats)
  - b. Nibco Check Valve 2-1/2" and larger: F - 918 – Y -LF (Buna-N Disc)
  - c. Nibco Check Valve 2-1/2" and larger: W - 920 -W-LF (Wafer)
  - d. Kitz Y & Check: A-22T
  - e. Kitz 2-1/2" and Larger #778 C.I.
  - f. Kitz Wafer Check 2-1/2" and Larger #7032
  - g. Apollo Check Valve 163 TLF
  - h. Apollo Check Valve 2-1/2" – Larger 910 FLF

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.
- D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.
- E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
  - 1. 1" valve for pipes 6" and larger.
  - 2. 3/4" valve for pipes smaller than 6".
  - 3. Terminate with pipe plug.
  - 4. Drain valves shall be ball valves.
- F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
- G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- H. Provide clearance for installation of insulation and access to valves.
- I. Provide access where valves are not exposed.

#### 3.2 VALVE TAGS

- A. Furnish valves with 1-1/2" diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4" letters, and valve numbers shall be 2" letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3' of the equipment being served and the service is obvious.
- B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the



material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

- A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION



SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
  - 1. Johns-Manville Micro-Lok AP-T
  - 2. Owens-Corning ASJ/SSL
  - 3. Knauf ASJ/SSL

PLUMBING PIPING INSULATION

- B. Cellular Glass Insulation (Foamglass):
  - 1. Pittsburg Corning
  - 2. Cell-U-Foam
- C. Aluminum Jacketing:
  - 1. Childers
  - 2. Pabco
  - 3. RPR
- D. Fiberglass reinforcing cloth mesh:
  - 1. Perma Glass Mesh
  - 2. Alpha Glass Mesh
  - 3. Childers Chil-Glas
  - 4. Vimasco
- E. Mastics and Adhesives
  - 1. Childers
  - 2. Foster
  - 3. Vimasco
  - 4. Armstrong 520 Adhesive
- F. Elastomeric Insulation
  - 1. Armacell
- G. Weather Resistant Coating
  - 1. WB Armaflex Finish
- H. Glass fiber blanket insulation
  - 1. Manville R-series Microlite FSKL
  - 2. Owens-Corning eD75 or ED100 RKF
  - 3. Knauf 0.75 PCF FSK

## 2.2 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
  - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

## 2.3 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum ¾" thick.
  - 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

## 2.4 CELLULAR GLASS INSULATION

- A. ASTM C552:
  - 1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
  - 2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

## 2.5 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall

## PLUMBING PIPING INSULATION

extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.

1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
  2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

## 2.6 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 adhesive.
- B. Vapor Barrier Finish:
1. Indoors: Provide as insulation coating Childers CP-35, white.
  2. Outdoors: Provide as insulation coating Childers Encacel X.
  3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
- C. Sealant. Provide Childers CP-76 vapor barrier sealant.
- D. Lagging Adhesive. Provide Childers CP-50.
- E. Other products of equal quality will be acceptable only upon approval.

## 2.7 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

## 2.8 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

## PART 3 – EXECUTION

### 3.1 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.
- C. Where domestic water pipes (1/2" & ¾" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.

- E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
  - 1. Domestic hot water and cold water (cold water piping is to be insulated in outside walls to 5' inside building, and in any location subject to freezing). Maintain insulation for domestic hot and cold water in Mechanical Rooms and Central Plant.
  - 2. Make-up water
  - 3. Horizontal sanitary drain piping that receives condensate
  - 4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body to elbow, all horizontal rain leaders, and first elbow turning down

### 3.2 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
- D. Apply a tack coat of fitting mastic over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
- F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

### 3.3 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
  - 1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
  - 2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
  - 3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
  - 4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
  - 5. Apply mastic to a wet film thickness of 3/64".
  - 6. Fabric shall not be visible after completion.
  - 7. Vapor seal flanges, valves and fittings with Childers CP-35.
- B. PVC fitting covers are not acceptable.

### 3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

- A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal.
- C. Install straps on 9" centers and at each circumferential lap joint.
- D. Cover and seal all exposed surfaces.
- E. The use of screws and rivets is not approved.
- F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

### 3.5 CONCEALED STORM DRAIN PIPING

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.
- B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.
- C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.
- D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

### 3.6 MISCELLANEOUS

- A. Install materials after piping has been tested and approved.
- B. Apply insulation on clean, dry surfaces only.
- C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

### 3.7 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

END OF SECTION





SECTION 22 08 00

PLUMBING SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

- 1.1.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.1.2. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2. SUMMARY

- 1.2.1. The purpose of this Section is to define responsibilities in the Commissioning Process. Additional system testing is required within individual Specification Sections.
- 1.2.2. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning requirements and coordination are detailed in Division 01. Division 20-25 Contractors shall be familiar with all parts of Division 01 and the Commissioning Plan issued by the Owner's CxA, shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- 1.2.3. Plumbing systems to be commissioned include the following:
  - 1.2.3.1. Domestic Water Heaters
  - 1.2.3.2. Domestic Water Circulation Pumps

1.3. DEFINITIONS

- 1.3.1. Refer to the General Commissioning Requirements for definitions.

1.4. SUBMITTALS

- 1.4.1. Contractor shall provide Owner and/or CxA with documentation required for Commissioning Work. At minimum, documentation shall include: Detailed Start-up procedures, full sequences of operation, Operating and Maintenance data, performance data, control drawings, and details of Owner-contracted tests.
  - 1.4.1.1. Shop drawings and product submittal data related to systems or equipment to be commissioned.
- 1.4.2. Contractor shall submit to Owner and/or CxA installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- 1.4.3. Where installation testing may be performed in a progressive manner (i.e., piping hydrostatic testing), the Contractor shall prepare and submit to the Owner, A/E team and CxA a testing plan that details how the progressive testing will be performed, documented and presented for approval prior to the start of any testing activities.
- 1.4.4. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process
  - 1.4.4.1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.

PLUMBING SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

- 1.4.4.2. Installation testing reports such as piping hydrostatic testing, piping chemical treatment and flushing, bolt flange torqueing, and any documentation associated with local code authority inspections or authorizations.
- 1.4.4.3. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.
- 1.4.4.4. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements.

## PART 2 - PRODUCTS

### 2.1. GENERAL

- 2.1.1. All materials and installation shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- 2.1.2. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process
- 2.1.3. Contractor is required to follow all applicable industry and site specific safety practices, lockout / tagout requirements, specialized PPE requirements, and provide qualified, trained personnel to execute Commissioning Process requirements.

### 2.2. TEST EQUIPMENT

- 2.2.1. Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- 2.2.2. 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.

## PART 3 - EXECUTION

### 3.1. CONSTRUCTION PHASE

- 3.1.1. In each purchase order or subcontract that is written for changes in scope, include the appropriate requirements for submittal data, Commissioning documentation, testing assistance, Operating and Maintenance (O&M) data, and training, as a minimum.
- 3.1.2. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Owner, CxA or Contractor to facilitate the Commissioning process.
- 3.1.3. Provide manufacturer's data sheets and shop drawing submittals of equipment.
- 3.1.4. Provide additional requested documentation to the Owner and/or CxA, prior to O&M manual submittals, for development of System Verification Checklists and Functional Performance Testing procedures.
  - 3.1.4.1. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information.

- 3.1.4.2. In addition, the installation, Start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Contractor and/or CxA.
- 3.1.4.3. This information and data request may be made prior to normal submittals.
- 3.1.5. During the installation, Start-up and initial checkout process, execute and document related portions of the System Verification Checklists for all commissioned equipment according to the procedures indicated in the Commissioning Plan.
- 3.1.6. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
- 3.1.7. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the System Verification Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that CxA, Owner and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.
- 3.1.8. Incorporate manufacturer's Start-up procedures with System Verification Checklists (SVC).
- 3.1.9. Provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.
- 3.1.10. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and A/E and retest the system and equipment.
- 3.1.11. During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests).
- 3.1.12. Provide training of the Owner's operating personnel as specified.
- 3.1.13. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
- 3.2. WARRANTY PHASE
  - 3.2.1. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.
    - 3.2.1.1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.
  - 3.2.2. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any deferred or seasonal testing.
- 3.3. INSTALLATION
  - 3.3.1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
  - 3.3.2. All installation shall be in accordance with the Project Documents.

3.4. TRAINING

- 3.4.1. Refer to the individual section of this Specification for specific training requirements on each system.
- 3.4.2. Refer to the General Commissioning Requirements and Division 01 for overall training requirements related to the Commissioning process and this project.

SECTION 22 11 16

DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

- A. Division 22 Plumbing
1. Valves, Strainers and Vents
  2. Pipe and Pipe Fittings - General
  3. Plumbing Piping Insulation
  4. Plumbing Fixtures and Fixture Carriers

PART 2 – PRODUCTS

2.1 PIPING AND FITTINGS

- A. Below Slab on Grade Piping for Water Entries:
1. 1-1/2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
  2. 2-inch and larger, provide Watts (Ames) IBR and IBR 2 304 stainless steel one piece in-building riser.
- B. Below Grade Piping Outside Building (beyond 5'-0" of building): Provide PVC water main pipe 4 inch through 12 inch in diameter in conformance with AWWA C900. When using 3" or smaller provide Schedule 80 PVC ASTM D1785 with ASTM D-2466 socket type fittings. Provide fittings in conformance with ASTM 2466. Furnish pipe with a minimum pressure rating of 150 lbs. per square inch. Provide PVC pipe as manufactured by Johns-Manville, CertainTeed, Clow or approved equal.
- C. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- D. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- E. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.
- F. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

PART 3 – EXECUTION

3.1 DRAINAGE

- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

DOMESTIC WATER PIPING AND APPURTENANCES

### 3.2 STERILIZATION

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Inject chorine disinfectant in liquid, powder, tablet or gas form throughout the system to obtain 50 to 80 Mg/L residual.
- A. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 20% of the outlets.
- B. Retain disinfectant in system for 8 hours (minimum), 24 hours (maximum). During the disinfection process, operate all valves and accessories.
- C. If final disinfectant residual tests less than 25 Mg/L, repeat treatment.
- D. Flush disinfectant from system until chemical and bacteriological tests prove water quality equal to that of the service main.
- G. Take samples no sooner than 24 hours after flushing from at least 10% of the outlets and from the water entry.
  - 1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
  - 2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.
- H. After final flushing, remove aerators, clean and replace.
- I. Chemical and bacteriological tests shall be conducted by a state certified laboratory.
- J. The firm performing the disinfection shall have chemical laboratory experience.
- L. Provide a laboratory report to indicate the following information.
  - 1. Name and address of the approved laboratory testing the samples.
  - 2. Name and location of the project and date the samples were obtained.
  - 3. Mg/L chlorine during retention.
  - 4. Mg/L chlorine after flushing.
  - 5. The coliform organism count. (An acceptable test shall show absence of coliform organisms.)
- M. If analysis does not satisfy the specified minimum requirements, repeat the disinfection procedure.
- N. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification of performance. An approved copy of each document shall be inserted in the Owner's manual.

### 3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

- A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

### 3.4 TESTING

- A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
- C. Use only potable water for the test.
- D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- F. Do not insulate or conceal piping systems until tests are satisfactorily complete.

### DOMESTIC WATER PIPING AND APPURTENANCES

- G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 COPPER PIPE CORROSION PROTECTION

- A. Corrosion protect copper tube piping systems:
  - 1. In the building slab.
  - 2. Beneath the building slab.
  - 3. Buried.
  - 4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.
- B. Cover copper tubing piping system with:
  - 1. "Tapecoat" TC Primer.
  - 2. "Tapecoat" CT cold applied coating tape.
- C. Install coating system as specified by the manufacturer.
- D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

- A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).
- B. Make repairs to small holes in accordance with the manufacturer's instructions.
- C. Retest the repairs using procedures listed above.
- D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION





SECTION 22 11 23

DOMESTIC WATER PUMPS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

- A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. Submit copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 – PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

DOMESTIC WATER PUMPS

- A. Pump Construction:
  - 1. Wet-rotor, in-line, single stage
  - 2. Bronze housings with ½" and ¾" sweat connections
  - 3. Stainless steel housing with union threaded connections
  - 4. Integrated check valve inside union fitting on a sweat pump housing
  - 5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
  - 6. Built-in timer
  - 7. Aquastat thermostatic control
- B. Acceptable manufacturers:
  - 1. Bell & Gossett
  - 4. Taco
  - 5. Grundfos

## 2.2 FLOW INDICATOR

- A. Flow Indicator
  - 1. Bronze Construction
  - 2. Rotating wheel
  - 3. Line Size
  - 4. Double Window
  - 5. Ernst Flow Industries Model EFI E-57-3

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
  - 1. Provide access space around pumps for service.
  - 2. Lubricate pumps prior to start-up.
  - 3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
  - 1. Operate at specified system fluid temperatures without vapor binding and cavitation.
  - 2. Are non-overloading in parallel and individual operation.
  - 3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

### 3.2 ALIGNMENT FOR BASE MOUNTED PUMPS

- A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified. Anchor, level and grout.
- B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.
- C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

### 3.3 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
  - 1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
  - 1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
  - 2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
  - 3. Submit readings for approval.
  - 4. Include the approved readings in the Owner's Maintenance Manual.

### 3.4 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
  - 1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
  - 2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
  - 1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

### 3.5 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
  - 1. A mechanical seal for each pump
  - 2. A set of bearings for each pump

END OF SECTION

SECTION 22 13 16

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

- A. Site Work:
1. Sanitary Sewers
  2. Excavation, Trenching and Backfilling for Utilities
- B. Division 22 Plumbing:
1. Pipe and Pipe Fittings
  2. Plumbing Fixtures and Fixture Carriers
  3. Drains, Cleanouts and Hydrants
  4. Earthwork

1.3 REFERENCES

- A. CISPI - Cast Iron Soil Pipe Institute
- B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All No-Hub clamps must have 4 bands minimum. Sizes 5" through 10" shall have six bands minimum.
1. No-Hub Clamps – Sanitary Waste:
    - a. Husky SD 4000
  2. No-Hub Clamps - Vents
    - a. Husky SD – 2000
    - b. Mission Rubber Co., LLC Heavy Weight Couplings
- B. Provide Husky shielded couplings Series 4200 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2" through 8" Series 4200.
- C. Cast Iron Soil Pipe and Fittings:
1. AB&I
  2. Charlotte Pipe and Foundry Co.
  3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

- A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
  2. Pipe shall conform to ASTM A74.
  3. No-hub couplings shall meet or exceed the latest specification standard CISPI 310 or ASTM C-1540 and conform to FM 1640. CISPI 310 Couplings shall be listed by NSF International.
  4. Rubber Gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
  5. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute
- B. Below Slab on Grade Piping:

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

1. Schedule 40 PVC plastic pipe and DWV fittings. 4" SDR pipe is not allowed.
  2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
  3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.
- C. Below Slab on Grade Piping for Grease Waste:
1. Schedule 40 CPVC pipe and fittings
  2. Solvent welded DWV joints shall conform to ASTM D3311 and be produced to dimensions specified in ASTM F 2618, NSF International, UPC, IAPMO IGS 210 and International Plumbing Code.
  3. Solvent Cement, Heavy Body; mustard yellow color, as tested by ASTM F 2618 / ASTM F493
  4. Manufacturer: Spears (only)

### 2.3 VENT PIPE AND FITTINGS

- A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
  2. Pipe shall conform to ASTM A74.
  3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
  4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
- B. Below Slab on Grade Piping:
1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.
- C. Above Slab Pipe.
1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations and equipment discharge.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards.
- D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside the building slab.
- E. All PVC underground shall be installed in accordance with ASTM D2321.

### 3.2 GRADE

- A. Give horizontal pipe grade of 1/4-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

### 3.3 DRAIN PIPE AND FITTINGS

- A. Offsets and Fittings.
1. Use reduction fittings to connect two pipes of different diameter.
  2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and

## SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

sixth-, eighth-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.

3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
  4. Do not use double combinations or cross fittings below slab.
  5. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8<sup>th</sup> bend fittings are not allowed for horizontal to horizontal piping systems per Code.
- B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.
- C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
  2. Provide cleanouts where soil lines change direction, every 75 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
  3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
  4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.
  5. Provide cleanout above all sanitary cross fittings and Figure 5 fittings in chase walls, etc.
  6. Do not provide gasket markers in carpeted areas. Do provide full cleanouts with top fully exposed.
  7. For large garbage disposers in kitchens, install a cleanout between the disposer and the P-trap and at the wall.
  8. Notify civil to have manholes at connections to main at each exit point.
- D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.
- 3.4 VENT PIPING
- A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.
- B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.
- C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.
- D. During demolition, abandoned plumbing vents are to be removed in their entirety. Do not cap the vent pipes below the roof deck and abandon in place. The hole in the roof is to be patched and made water tight.

### 3.5 TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:
1. Test pipe below slab on grade before backfilling and connecting to city sewers.
  2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
  3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.

#### SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
  5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
  6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
  7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
  8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.
- B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
  2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
  3. Test for 6 hours without any drop in the water level.

### 3.6 RODDING SEWERS

- A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.
- B. All sanitary soil and waste lines below building 3" and larger shall be internally videotaped at time of substantial completion and on existing piping prior to construction. All videotaping shall include on-screen date and time and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. CFISD must be notified 24 hours prior to start time of video inspection. An Owner's Representative, CFISD plumbing foreman, or his designee shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.
- C. This work shall be done in the presence of the Owner's Representative, CFISD plumbing foreman, or his designee as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

### 3.7 SMOKE TESTING – LIQUID SMOKE SYSTEM

- A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing for finding leaks in all interior of building sanitary sewer piping, acid waste and vent piping, and sanitary vent piping above and below building slab prior to cover up.
  2. Contractor must use a laboratory tested safe liquid smoke with a patented liquid smoke generating system. The liquid smoke must be contained in a pressure tank with inline filter and quick disconnect.
  3. Contractor shall provide a continuous smoke flow for testing the entire piping system in lieu of partial testing done by sections at a time. Partial testing will not be acceptable.
  4. Smoke generating system must generate up to 3 hours or more of continuous and constant smoke. Generating system must have a metering valve to precisely control smoke flow and density. Smoke generating system must have a 4" x 6" industrial flexible mining duct for connection to vent stack or cleanout or sit atop a manhole outside.
  5. Smoke generating system must be power full enough to push smoke through the smallest leaks.
  6. The liquid smoke must not leave any stains or odors.
  7. The liquid smoke shall not contain Zinc Chloride, a listed toxic compound in OSHA 1915,1000 – Air contaminants.

### SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

8. Smoke generating system must have a means to atomize the liquid smoke and have an enclosed fan system capable of up to 700 cfm with adjustable inlet damper control to adjust cfm as necessary for the size of system.
9. Provide Hurco "Power smoker "with Hurco "LiquiSmoke" system or approved equal. No smoke bombs allowed.
10. All plumbing fixtures must be installed including floor drains with wetted trap seals.
11. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Plug piping as necessary as to force all smoke into building. Smoke can also be admitted through a manhole. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
12. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
13. Typical findings from indoor smoke testing may include:
  - a. Dry traps in floor drains
  - b. Improperly capped sewer lines or vents
  - c. Broken sewer lines or vents
  - d. Cross connected sewer vents and drains
  - e. The drawing of air emanating from sewer vents into intakes of air exchange systems
  - f. Poorly glued pipe joints
  - g. Loose no-hub couplings
14. An Owner's Representative shall be present during smoke testing.

END OF SECTION





SECTION 22 14 13

ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install roof drains, drain pipes and accessories.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Pipe and Pipe Fittings - General; for general piping requirements.
  - 2. Drains and Cleanouts.
  - 3. Plumbing Piping Insulation.
  - 4. Earthwork

1.3 REFERENCES

- A. CISPI – Cast Iron Soil Pipe Institute
- B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

- A. Cast Iron Soil Pipe and Fittings
  - 1. AB&I
  - 2. Charlotte Pipe and Foundry Co.
  - 3. Tyler Pipe / Soil Division

2.1 STORM PIPE AND FITTINGS

- A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
- C. Provide Husky shielded couplings, Series 4200 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2" through 8" use Series 4200.
- D. All no-hub couplings connections to roof drains to piping must be located below the metal decking.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent

ROOF DRAINAGE PIPING AND APPURTENANCES

movement. Riser clamps to be used for each floor, not to exceed 15'-0".

- C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards, and in accordance with ASTM D2321.

### 3.2 GRADE

- A. Give horizontal lines minimum grade of 1/8 inch per foot.

### 3.3 TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:
1. Test pipe below slab on grade before backfilling and connecting to city sewers.
  2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
  3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
  4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
  5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
  6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
  7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
  8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.
- B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
  2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
  3. Test for 6 hours without any drop in the water level.

END OF SECTION

SECTION 22 20 00

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Earthwork
  - 2. Valves, Strainers and Vents
  - 3. Insulation
  - 4. Other Piping Sections

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
  - 1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
  - 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
  - 3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
  - 1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
  - 2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
  - 3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
  - 4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
  - 5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.

6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
  1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
  2. 6" through 10" pipe size coupling housing minimum of 4" width.
  3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.
- G. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.
- H. Ring-Tite Joints: Furnish joints for installation according to manufacturer's recommendations. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. JM Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.
- I. Press fittings for copper pipe 1/2" to 4": Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

## 2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
  1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

## 2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

## 2.5 GASKETS

- A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

## 2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

## 2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

### PART 3 – EXECUTION

#### 3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.
- E. Press Connections: Copper press fittings ½" through 4" shall be applied in accordance with the manufacturer's installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-"Pro-Press".

#### 3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

#### 3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

### 3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion.
- F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

### 3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

### 3.6 PIPE SUPPORTS ON ROOF

- A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV

inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

### 3.7 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

### 3.8 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

### 3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
  - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
  - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
  - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
  - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

### 3.10 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

### 3.11 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

### 3.12 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before



- placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.
- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
  - C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
  - D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
  - E. Dispose of water in approved manner.
  - F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.
  - G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
  - H. Submit status reports upon completion of each phase of work on each system.

### 3.13 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

### 3.14 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
  - 1. Both sides of penetrations through walls, floors and ceilings.
  - 2. Close to valves or flanges.
  - 3. Intervals on straight pipe runs not to exceed 50 feet
  - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

END OF SECTION

SECTION 22 31 00

DOMESTIC WATER SOFTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Water softening equipment to remove hardness, (calcium carbonate), to the extent that the effluent from the water softener shall contain less than one grain per gallon of hardness, as determined by an accepted soap hardness test method.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Domestic Water Piping.
  - 2. Plumbing Piping Insulation.
  - 3. Valves, Strainers and Vents.

1.3 SUBMITTALS

- A. Submit shop drawings and product data as specified.
- B. Submit manufacturer's certified capacity data.
- C. Submit manufacturer's installation, start-up and service instructions.
  - 1. Electrical interlocks.
- D. Submit wiring diagram.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bruner
- B. Mueller
- C. Marlo

2.2 CAPACITY

- A. The water softening equipment shall have the capacity as scheduled on the drawings.

2.3 TANKS

- A. Design tanks for a working pressure of 100 psi.
- B. Design the side shell height to allow a minimum free-board space of 50% of the mineral bed depth for adequate expansion during backwashing.
- C. For FRP softener tanks: tank construction shall be FRP one-piece seamless molded vessel, 100psi working pressure and 150psi test pressure design. Lower distributor system shall consists of a full flow non-clogging PVC slotted distributor tube. The tank shall be non-code rated for 100 psig working pressure.
- D. Tanks shall have a port on the top of the tank for filling.
- E. Tanks will be supported on approved corrosion protected steel legs.

2.4 COLLECTOR

DOMESTIC WATER SOFTENING SYSTEM

- A. Provide the softener with an approved lower distribution system:
  - 1. Nonclogging strainers to collect soft water and distribute the backwash water.
  - 2. Covered with a minimum of 3" of 1/8" x 1/16" gravel to ensure even distribution of water.

## 2.5 BRINE SYSTEM

- A. Provide a combination salt storage and brine measuring tank with cover.
  - 1. Large enough to hold salt for at least 4 regenerations of full salting between refills.
  - 2. Molded of corrosion free, rigid polyethylene.
- B. Equip the brine tank with:
  - 1. An elevated salt plate for the collection of concentrated brine.
  - 2. A suitable chamber for housing an automatic air eliminator safety valve.

## 2.6 AUTOMATIC CONTROLS

- A. Provide a multi-port main control valve or nest of diaphragm valves.
  - 1. Hydraulically actuated.
  - 2. Four position type.
  - 3. Accomplish the regeneration steps of backwash, brine-slow rinse, rapid rinse and service.
  - 4. Include fixed and self-adjusting flow regulators necessary to properly control the rate of flow during the backwash and brine-rinse.
  - 5. Pressures between 30 and 120 psi.
  - 6. Designed to prevent hard water bypass to service during the regeneration cycle.
  - 7. Shall be connected with factory pre-piped galvanized piping.
- B. Control regeneration by a flow sensor with push-button manual override.
  - 1. Permit regeneration at any time of day or night, any day or every day of the week.
  - 2. Make provision for individual adjustment of the backwash and brine-rinse cycles.
  - 3. Provide dry contact outputs to the DCS system from the electronic controller of general alarm conditions and flow sensor data.
- C. Enclose control mechanisms in a gasketed moisture resistant case, rated as a NEMA III or NEMA 12 enclosure and conforming to UL specifications.

## 2.7 AUTOMATIC BRINE SYSTEM

- A. Provide a control system to:
  - 1. Open to admit brine.
  - 2. Close to prevent the entrance of air.
  - 3. Refill the brine tank with the proper amount of water.
- B. Accomplish regulation of the brine dosage by adjustment of a salt dosage dial in the time clock case.
- C. Design the system to allow proper refilling regardless of the salt level in the brine tank.
- D. Furnish a float-operated safety valve as standard equipment to safeguard against brine tank overflow.

## 2.8 MINERAL

- A. Charge the system with a mineral of the type designed as non-phenolic polystyrene resin.
  - 1. Minimum exchange capacity of 30,000 grains per cubic foot when regenerated with 0.5 lbs. of salt per 1,000 grains of exchange capacity.
  - 2. A solid, of the proper particle size, (not more than 1.8% through 50 mesh U.S. standard screens, wet screening).
  - 3. Contain no agglomerates, shells, plates or other shapes which might interfere with the normal function of the water softener.

## 2.9 WATER TESTING EQUIPMENT

- A. Provide a sample cock installed for obtaining samples of the effluent water.
- B. Provide a complete water testing kit for conducting a soap test.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. System pipe shall be Type "L" copper with dielectric unions connecting to factory pre-piped galvanized piping, or CPVC pipe and fittings as required to meet local codes.
- B. Arrange piping for easy dismantling to permit cleaning and service.
- C. Install the system in accordance with the manufacturer's installation, start-up and service instructions.

#### 3.2 INSTRUCTIONS

- A. Provide a complete set of instructions covering the installation, operation and servicing of the water softener.
- B. Insert in the Owner's manual.

#### 3.3 SYSTEM MANUFACTURER START-UP SERVICE

- A. Provide the services of factory trained service technicians to start up the system.
  - 1. Technicians shall be trained and experienced on the work they conduct.
- B. 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.
- C. Follow the manufacturer's start up procedures.
  - 1. Verify interlocks.
  - 2. Test and verify operation of controls.
  - 3. Calibrate controls.

END OF SECTION



SECTION 22 33 13

TANKLESS ELECTRIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Tankless electric water heaters for domestic water systems.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Domestic Water Piping.
  - 2. Plumbing Piping Insulation.
  - 3. Division 26 Electrical.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Chronomite
- B. EEMAX
- C. Stiebel Eltron

2.2 PRODUCTS

- A. Provide tankless, flow switch activated heater.
- B. Hot water temperature range of 103°F to 120°F.
- C. 0.5 GPM flow rate.
- D. Low pressure model if required. Contractor shall verify pressure at site.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install where shown on Drawings and in accordance with manufacturer's requirements.

3.2 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION



SECTION 22 34 32

GAS-FIRED DOMESTIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Gas-fired domestic hot water heating systems, including hot water heaters, storage tanks, control valves, and pressure and temperature relief valves, as required.

1.2 RELATED ITEMS

- A. Division 22 Plumbing:
  - 1. Domestic Water Piping
  - 2. Gas Piping
  - 3. Flue Piping
  - 4. Plumbing Piping Insulation

1.3 CERTIFICATION

- A. Provide water heater listed by UL Laboratories, according to ANSI Z21.10 Standards governing storage-type water heaters. Must meet ASHRAE/IESNA 90.1-1999 and be design-certified by Underwriter's Laboratories for 180°F water. Must meet SCAQMD Rule 1146.2 for low-nox emissions.

PART 2 - PRODUCTS

2.1 CAPACITY

- A. Water heaters shall have the storage capacity and gallons per hour recovery at 100°F rise as scheduled.

2.2 TANK

- A. Construct the tank with a 125 psi ASME rating in accordance with the ASME Code, Section IV. Tank shall have a seamless glass-lined steel tank construction.
- B. Powered Anodes.

2.3 BURNER

- A. A spiral-shaped heat exchanger placed entirely inside the tank which shall be glass-lined on the flue gas side to protect against acidic flue gas condensate.
- B. Heater shall have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.

2.4 INSULATION

- A. Insulate the water heater with factory applied foam insulation and trim with a heavy-gauge, enameled steel jacket.

2.5 CONTROLS

- A. Furnish 120V controls for heaters of 100,000 BTUH and above. Controls shall be an integrated solid-state temperature and ignition control device with integral diagnostics, LED fault display capability, and a digital display of temperature system.

2.6 FLUE



- A. This water heater(s) shall be suitable for sealed combustion direct-venting with 4" diameter Polypropylene Pipe (UL 1738) air intake pipe and 4" diameter Polypropylene Pipe (UL 1738) exhaust pipe for a total of 70 feet of intake and 70 feet of exhaust. Provide a properly sized thermal expansion tank as scheduled on drawings. Refer to manufacturer's installation instructions for material types used in air intake and exhaust pipe use.

## 2.7 CARBON MONOXIDE MONITORING SYSTEM

- A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room when combustion air is ducted to boilers. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler's burner upon loss of power to the detector.
- B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module.
  - 1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
  - 2. NEMA 1 Enclosure
  - 3. Complies with Texas State Boiler Code 65.603-2015
  - 4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
  - 5. Provide expansion board for additional equipment interlocks.

## 2.8 ACCEPTABLE MANUFACTURERS

- A. A.O. Smith
- B. State
- C. Lochinvar
- D. Bock
- E. Rheem/Ruud
- F. PVI

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install a line size valve in the cold water supply close to each heater and a line size plug cock in the gas supply close to each heater.
- B. Provide approved dielectric couplings at all cold water and hot water connections to storage tank, and at pressure and temperature relief valve connection.
- C. Install according to manufacturer's specifications and pipe as shown.
- D. Install water heater in galvanized drain pan piped to floor drain. Provide ¾" outlet connection. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.
- E. Provide and install acid neutralization box for each heater on condensate from exhaust vent.

### 3.2 STARTUP

- A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.
- B. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner /

Engineer shall be present to witness test.

3.3 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION



SECTION 22 40 00

PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Drains, Hydrants and Cleanouts.
  - 2. Domestic Water Piping.
  - 3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Plumbing Fixtures (Vitreous China):
  - 1. American Standard.
  - 2. Kohler.
  - 3. Toto
  - 4. Zurn
  - 5. Sloan
- B. Plumbing Faucets:
  - 1. Chicago
  - 2. T&S Brass (Manual Faucets only)
  - 3. American Standard
  - 4. Moen Commercial
  - 5. Zurn
- C. Supports and Carriers:
  - 1. Josam
  - 2. Zurn
  - 3. J.R. Smith.
  - 4. Wade
  - 5. Watts
- D. Flush Valves:
  - 1. Sloan "Royal"
  - 2. Zurn "XL"
  - 3. Toto "TMT1HNC-32"
  - 4. Moen Commerical
- E. Supplies, Stops and Chrome Plated Tubular Brass:
  - 1. McGuire
  - 2. T&S Brass
- F. Water Closet Seats:
  - 1. Beneke

PLUMBING FIXTURES AND FIXTURE CARRIERS

2. Church
  3. Olsonite
  4. Bemis
  5. Centoco
- G. Electric Drinking Fountains: (Stainless Steel Only)  
(No electronic solenoid valves; only mechanically operated valves.)(No Filtered Units)
1. Halsey Taylor
  2. Elkay
- H. Electric Drinking Fountains (Stainless Steel Only) (Bi-Level with Bottle Filler)
1. Halsey Taylor Model HTHBHVR8BL-NF, no filter.
- I. Outdoor Drinking Fountains:
1. Acorn
  2. Haws
- J. Floor Drains:
1. Josam
  2. Zurn
  3. J.R. Smith
  4. Wade
  5. Watts
- K. Cleanouts:
1. Josam
  2. Zurn
  3. J.R. Smith
  4. Wade
  5. Watts
- L. Shower Systems:
1. Bradley
  2. Willoughby
- M. Shower Valves
1. Acorn
  2. Bradley
- N. Shower Stall
1. Aquabath
  2. LASCO
  3. Aquarius
  4. Best Bath Systems (Access)
- O. Stainless Steel Sinks:
1. Elkay
  2. Moen Commercial
- P. Mop Sinks:
1. Crane Fiat
  2. Stern Williams
  3. Mustee
- Q. Roof Drains:
1. Josam
  2. Zurn
  3. J.R. Smith
  4. Wade
  5. Watts
- R. Thermostatic Mixing Valves

1. Symmons
  2. Leonard
- S. Emergency Safety Equipment
1. Bradley
  2. Encon
  3. Chicago
- T. Shock Arrestors:
1. Precision Products
- U. Backflow Preventors
1. Apollo RPLF 4A Series for 2-1/2 inch and larger
  2. Febco
  3. Watts
- V. Hose Bibbs
1. Wade
  2. Chicago
  3. Josam
  4. Woodford
  5. Zurn
  6. J.R. Smith
- W. Wall Hydrants
1. Wade
  2. Woodford
  3. Zurn
  4. J.R. Smith
  5. Josam
- X. Solids Interceptors & Hair/Lint Traps
1. Watts
  2. J.R. Smith
  3. Zurn
- Y. Trap Primers
1. Precision Plumbing Products (All Brass construction)
- Z. Interceptors (Central Outdoor)
1. Park USA
  2. Hydro-Recycle
- AA. Urinal Strainers
1. American Standard Washbrook FloWise Vandal Resistant Strainer  
#7381408-200.002A  
Note: Urinals must accommodate this strainer.
- BB. Shampoo Sink
1. Belvedere
- CC. Roof Hydrants
1. Mapa Products Model MPH-24-FP:24/9  
Note: Roof hydrants with a drain connection are not allowed.

## 2.2 REQUIREMENTS

- A. Refer to the drawings for equipment to be supplied.

## PART 3 - EXECUTION

### PLUMBING FIXTURES AND FIXTURE CARRIERS

3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions.
- B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.
- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
- G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
- H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.
- I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.
- J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel screws. (No Vandal Resistant Screws)
- K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION

SECTION 22 63 11

GAS PIPING AND APPURTENANCES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.
- B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.
- C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Plumbing Pipe and Fittings
  - 2. Valves and Vents

1.3 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
  - 1. Schedule 40 ASTM A 53 black steel pipe
  - 2. Factory fabricated socket weld fittings.
- B. Pipe Larger than 2 inch:
  - 1. Schedule 40 ASTM A 53 black steel pipe.
  - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
  - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
  - 2. Ground joint unions, with bronze seat.
  - 3. Flange joints for pipe larger than 2 inch in diameter.
- D. Flanges:
  - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

- A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.
- B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe

GAS PIPING AND APPURTENANCES



Industries, Inc. or Performance Pipe. 1-1/2" to 2" shall be SDR 11 and 3" to 4" shall be SDR 11.5.

- C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

## 2.3 VALVES

- A. See Section 22 05 23.

## 2.4 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.
- C. Emergency shut off for science classrooms; color: yellow.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.
- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
  - 1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
  - 2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.
- F. Weld all gas piping above grade.
- G. Provide test ports and isolation valves to enable proper testing of system in the future.
- H. Provide isolation valve and unions across regulators for proper removal.
- I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.
- J. Gas Pressure Regulators / Vents:
  - 1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Never

## GAS PIPING AND APPURTENANCES

use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors. Headers with various installed devices can cause regulator malfunction.

2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
5. When installed inside building route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer's responsibility to ensure the vent line is exhausting to a safe environment
8. Adhere to all applicable codes and regulations.

### 3.2 TESTING GAS PIPING

- A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.
- B. Test joints with a soap solution while lines are under pressure.
- C. Repair leaks.
- D. Final gas test shall be with a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure. Final gas test must be witnessed by Cy-Fair ISD Plumbing Department personnel.
- E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.
- F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
  1. To find form online, go to: Texas School Gas Test Form
- G. School renovations projects shall have all gas piping tested. Report and document gas leaks found to the Architect and Engineer. Repair leaks at no additional cost to the Owner.
- H. The District must be notified to witness any gas system test.
- I. Send copy of gas piping material and domestic manufacture for approval to Bill Smith and Shannon Thompson at CFISD. Provide test valve opening downstream of main gas shutoff and meter but before building entry with valve to be Nibco T585-70UL (1/4") with plug cap.

### 3.3 IDENTIFICATION CONDUCTOR

#### GAS PIPING AND APPURTENANCES

- A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
  - B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
    - 1. Bolted gasketed cover with stainless steel screws.
    - 2. Screw type terminal strip.
    - 3. Legend on cover "gas pipe identification conductor."
  - C. Set in concrete pad.
- 3.4 PAINT EXPOSED OUTSIDE GAS PIPE
- A. Interior and Exterior Gas piping shall be protected from rust.
  - B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

SECTION 23 01 00

HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element.
  - 2. Contractor information.
  - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
  - 4. All parts and maintenance manuals for items of equipment.
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates).
  - 9. Control operations/equipment wiring diagrams.
  - 10. Schedule of filters for each item of equipment.
  - 11. Schedule of belts for each item of equipment.
  - 12. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 – PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".  
Maximum ring size: 3".

HVAC OPERATING AND MAINTENANCE MANUALS

- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

### PART 3 – EXECUTION

#### 3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
  - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
  - 2. Format:
    - a. Size: 8-1/2" x 11".
    - b. Text: Manufacturer's printed data or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable.
    - c. Identity of general subject matter covered in the manual.
  - 6. Binder as specified.
- B. Content of Manual:
  - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number.
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer.
      - 2) Maintenance contractor as appropriate.
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement.
    - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  - 2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
  - 3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems.
      - 2) Control and flow diagrams.
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  - 4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  - 5. Copy of each warranty, bond and service contract issued.
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure.
      - 2) Instances that might affect validity of warranties or bonds.

6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.

1. Content for each unit of equipment and system as appropriate:
  - a. Description of unit and component parts.
    - 1) Function, normal operating characteristics, and limiting conditions.
    - 2) Performance curves, engineering data and tests.
    - 3) Complete nomenclature and commercial number of replaceable parts.
  - b. Operating procedures:
    - 1) Start up, break-in, routine and normal operating instructions.
    - 2) Regulation, control, stopping, shut down and emergency instructions.
    - 3) Summer and winter operating instructions.
    - 4) Special operating instructions.
  - c. Maintenance procedures:
    - 1) Routine operations
    - 2) Guide to trouble-shooting.
    - 3) Disassembly, repair and reassembly.
    - 4) Alignment, adjusting and checking.
    - 5) Routine service based on operating hours.
  - d. Servicing and lubrication schedule. List of lubricants required.
  - e. Manufacturer's printed operating and maintenance instructions.
  - f. Description of sequence of operation by control manufacturer.
  - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - 1) Predicted life of part subject to wear.
    - 2) Items recommended to be stocked as spare parts.
  - h. As installed control diagrams by controls manufacturer.
  - i. Complete equipment internal wiring diagrams.
  - j. Schedule of filters for each air handling system.
  - k. Schedule of belts for each item of equipment.
  - l. Each Contractor's coordination drawings.
  - m. As installed color coded piping diagrams.
  - n. Charts of valve tag number, with location and function of each valve.
  - o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
  - p. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 23.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide extended compressor warranty certificates.

END OF SECTION



SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.
- B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Mechanical work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department
  - 5. Texas Department of Licensing & Regulations (ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored

MECHANICAL GENERAL PROVISIONS



pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's seal, name, address and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
  - 6. Indicate exact location of all underground mechanical piping and elevation.
  - 7. Indicate exact location of all underground electrical raceways and elevations.
  - 8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
  - 10. Exact location of all electrical equipment in and outside of the building.
  - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 12. Cloud all changes.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

#### 1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

#### 1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period

### MECHANICAL GENERAL PROVISIONS

make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and

MECHANICAL GENERAL PROVISIONS

strainers. Replace air filters.

### 3.3 LUBRICATION, REFRIGERANT AND OIL

- A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.
- B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.
- C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

### 3.4 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
  - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Doweled to existing slab
- D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

### 3.5 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
  - 1. Provide the training during the Owner's regular working day.
  - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.
- B. Time to be allocated for instructions.
  - 1. Minimum of 40 hours dedicated instructor time.
  - 2. 8 hours on each of 5 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
  - 1. One copy to the Owner.
  - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.6 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
  - 1. Designation approved by Architect/Engineer.
  - 2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
  - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

### 3.7 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

### 3.9 INDOOR AIR QUALITY

- A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.
- B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.
- C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.
- D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.
- E. Utilize manufacturer's recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.
- F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.
- G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution

## MECHANICAL GENERAL PROVISIONS

system.

- H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION

SECTION 23 05 10

HVAC CONTRACT QUALITY CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

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

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK-UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock-up has been approved in writing.

HVAC CONTRACT QUALITY CONTROL

- C. Acceptable mock-ups in place shall be retained in the completed work.
- D. Perform tests and submit results as specified.

#### 1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
  - 1. Rough-in.
  - 2. Finish with all appurtenances in place.
  - 3. Insulation installed.
  - 4. Demonstrations.

### PART 2 – PRODUCTS

#### 2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

### PART 3 – EXECUTION

#### 3.1 AIR HANDLING UNIT

- A. Mock-up an air handling unit, completely installed, including:
  - 1. Piping connections; including thermowells, test stations, test wells and other piping appurtenances.
  - 2. Pipe insulation.
  - 3. Condensate drain piping.
  - 4. Electrical connections.
  - 5. Ductwork beyond the first transition.
  - 6. Control valves and bypass.
  - 7. Cabinet/internal vibration isolation.
  - 8. Block valves and balancing valves.
  - 9. Duct insulation.
  - 10. Instrumentation.
- B. Tests: Air flow at scheduled static pressure.
- C. Demonstrate:
  - 1. Filter accessibility.
  - 2. Accessibility to drain and components for service.
  - 3. Controls sequence.

#### 3.2 DUAL DUCT TERMINAL BOX

- A. Mock-up a Dual Duct Terminal Box completely installed, including:
  - 1. Electrical connections.
  - 2. Duct connection beyond first transition.
  - 3. Cabinet/internal vibration isolation.
  - 4. Suspension system.
- B. Tests: Air flow at scheduled static pressure.
- C. Demonstrate:
  - 1. Control Sequence.
  - 2. Accessibility to components for service.

#### 3.3 HOT AND CHILLED WATER CIRCULATING PUMPS

- A. Mock-up one each system pump, completely installed including:
  - 1. Pump mounted on housekeeping pad.
  - 2. Auxiliary drain pan. (Chilled water only)
  - 3. Piping to a point beyond the complete valve and instrumentation assemblies.
  - 4. Strainers with blowdown.

5. Flexible piping connection.
6. Pipe supports.
7. Pipe insulation.
8. Pump painting.
9. Electrical connections.

3.4 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION





SECTION 23 05 11

MECHANICAL ALTERATIONS PROJECT PROCEDURES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing

MECHANICAL ALTERATIONS PROJECT PROCEDURES

drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify actual HVAC supply and return piping connections. Verify flow direction and depth prior to connection to existing plumbing systems.

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems and HVAC coils prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

### 3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping, ductwork and connections to maintain existing systems in service during construction.
- C. Existing HVAC and Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. 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 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Mechanical systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping, grilles, boxes and ductwork coincident with the construction.
- G. Remove or relocate existing piping, grilles, ductwork or housekeeping pads as occasioned by new or remodeled construction. Cap unused HVAC or domestic piping and duct beyond the new finish line.

- H. Relocate all HVAC and or domestic piping, grilles, boxes and ductwork as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities, which do not provide service to the buildings that remain.
- K. Remove existing plumbing or mechanical vent penetrations through roof not to be reused.

#### 3.4 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- 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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.
- D. HVAC, Plumbing, piping, ductwork and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping and ductwork 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.
- H. Existing mechanical piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

#### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural

value or integrity of affected portion of work.

- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

### 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing mechanical equipment in renovated areas as specified in Section 23 05 00 Mechanical General Provisions.

### 3.7 REFRIGERANT DISPOSAL

- A. Contractor shall dispose of refrigerant from all DX equipment including refrigerant piping per OSHA, EPA, Federal, State and Local Codes.

END OF SECTION

SECTION 23 05 12

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by these specifications as outlined below.
- B. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- C. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale:  $\frac{1}{4}" = 1'-0"$ .
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
  - 1. Actual mechanical equipment and components to be furnished
  - 2. Service clearance
  - 3. Relationship to other equipment and components
  - 4. Roof drains and leader piping
  - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
  - 1. Ductwork shop drawings
  - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
  - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and contact number.
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
  - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
  - 2. Associated items which require correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a re-submittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions,

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA



field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule
  - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 23 05 13

ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
  - 1. Motors for mechanical equipment.
  - 2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
  - 5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
  - 6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
  - 7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
  - 8. Pipe heat tracing.
  - 9. Cooling tower vibration switch/interlock/reset.
  - 10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
  - 11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
  - 12. Wiring of all related circulating water system chemical treatment devices.
    - a. Low voltage electric contacting water meter
    - b. Solenoid valve/blow-down assembly
  - 13. Radiant heater timer switches and/or thermostats
  - 14. Low Voltage thermostat wiring
  - 15. Wiring for pump motor internal heaters
- C. Refer to Division 23 Controls Sections for related control system wiring.
- D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.
- E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.
- F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

ELECTRICAL PROVISIONS OF HVAC WORK

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 – PRODUCTS

2.1 MOTORS

- A. Provide motors for mechanical equipment manufactured by one of the following:
1. Baldor Electric Company.
  2. Century Electric Div., Inc.
  3. General Electric Co.
  4. Louis Allis Div.; Litton Industrial Products, Inc.
  5. Lincoln Electric
  6. Marathon Electric Mfg. Corp.
  7. Reliance Electric Co.
  8. Westinghouse Electric Corp.
  9. WEG
  10. U.S. Motors
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:
- C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, premium efficiency motors, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
  2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
  3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
  4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
  5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.
- I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.
- J. Provide TEFC or TEAO motors on all Air Handling Units, Pumps, Supply Fans, Cooling Towers and

Fan Coil Units with motors larger than 1 HP.

## 2.2 EQUIPMENT FABRICATION

- A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

## 2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

- A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.
- B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer's recommendations.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.
- C. Install all electrical and control conduit into the bottom only of all electrical enclosures for motors, VFD cabinets, control cabinets, chillers, etc. (No top or side cabinet penetrations) Top of electrical enclosure must be kept water tight. Top or side cabinet penetrations will not be accepted inside or outside of the building.
- D. Motor Connections: For motors 10 HP and larger, at the motor connection do not use wire nuts. Provide listed insulated multitap connectors or provide copper alloy split bolt connection, or compression lugs and bolts: insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape.

END OF SECTION



SECTION 23 05 14

HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

- A. Division 23 – Mechanical:
  - 1. Insulation
  - 2. Fan/Coil Units
  - 3. Air Handling Units
  - 4. Chilled Water Pumps
  - 5. Air Compressor Storage Tanks
  - 6. Equipment Drain Pans

PART 2 – PRODUCTS

2.1 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings.
- B. For Air Handling Units – Schedule 40 Galvanized Steel Pipe.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install the system to facilitate easy removal.
  - 1. Use threaded plugged tee at each change of direction to permit cleaning.
  - 2. Install a cleanout every 50 feet of straight run piping
  - 3. Maintain a positive slope on all piping
- B. Install a water seal trap leg based on the fan pressure.
  - 1. Size the length of the trap leg 1 inch larger than the actual system pressure.
- C. Install traps and cleanout as shown in the drawing details.
  - 1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

- A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

- A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.
- B.
- B. Provide secondary drain line to approved location whenever possible.

END OF SECTION



SECTION 23 05 17

HVAC ACCESS DOORS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Automatic closing and latching mechanism
- F. Prime coat finish
- G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB



- C. Acudor
- D. Elmdor

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
  - 1. 36" x 24" for Mechanical HVAC equipment related items
  - 2. 18" x 18" for electrical related items
  - 3. 12" x 12" minimum for Fire and Smoke dampers

END OF SECTION

SECTION 23 05 18

VARIABLE FREQUENCY INVERTER

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a variable frequency inverter for the following equipment items.
  - 1. Variable Volume Air Handling Units.

1.2 RELATED WORK

- A. Division 23 Mechanical
  - 1. Electrical Provisions of Mechanical Work.
  - 2. Air Handling Units
  - 3. Building Management Control System Sequences

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical to ensure that intended functions are achieved.
- B. Coordinate the size of the variable frequency inverter with the equipment being served by the inverter. The rated current output amps are to be equal to or greater than motor rated full load amps.

1.4 SUBMITTALS

- A. Submit manufacturer's information and shop drawings as specified.
  - 1. Complete technical details.
  - 2. Dimensions and manufacturer's installation manual.
  - 3. Schematic diagrams of the circuitry and field connections.
  - 4. Manufacturer's start-up manual.

1.5 STANDARDS

- A. UL.
- B. CSA.
- C. ISO 9001
- D. NEC
- E. FCC

1.6 WARRANTY

- A. Provide a three year parts and labor warranty from date of Substantial Completion. Provide warranty in writing to Owner and HVAC supervisor with applicable warranty coverage dates.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. ABB
- B. Danfoss Graham
- C. Yaskawa

VARIABLE FREQUENCY INVERTER

## 2.2 CABINET

- A. The inverter and all accessories shall be provided within a wall mounted UL Listed NEMA 1 enclosure in interior AHU mechanical rooms and in NEMA 12 enclosure with deadsides and removeable, gasketed doors with provisions for locking in all Plant locations and pump rooms. Cabinet shall be constructed of metal for reduction of radio frequency interference (RFI) and electromagnetic frequency interference.

## 2.3 INTERFERENCE WITH OTHER SYSTEMS

- A. The inverter shall be designed and constructed to comply with IEEE Standard 519-1993 with respect to line noise and RFI generation. All units shall generate less than 3% total harmonic distortion back to the incoming power line at the point of common connection with sensitive equipment. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in Table 1.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.
- B. Dual DC Bus filtered chokes (factory installed and wired in the drive enclosure) equivalent to 5% input line reactors shall be provided to minimize harmonics reflected onto the input line.
  - 1. Shall not interfere with computer and other electronic systems in the building.
  - 2. If not inherently protected, provide a suitable isolation transformer.
  - 3. The system shall not produce spikes on the incoming line.
- C. Any inverter that generates sufficient electrical line noise to interfere with the operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.

## 2.4 PROTECTIVE CIRCUITS

- A. Provide the following protection:
  - 1. Input line fuses or molded case circuit breaker rated at 100 AIC.
  - 2. Input line noise suppression with MOV's (metal oxide varistors) and snubber circuits. MOV's shall be provided across incoming line terminals, AC input reactors, DC choke filters, and transistors to protect inverter from voltage surges and spikes.
  - 3. Protection of solid state inverter devices by limiting output current to 110% of inverter rating, automatically prevent overcurrent trip due to momentary overload conditions.
  - 4. Current limiting DC buss fuse between input and output sections of inventor.
  - 5. Input overvoltage trip.
  - 6. Input undervoltage (-12%) trip.
  - 7. Instantaneous overcurrent protection of solid state inverter devices.
  - 8. Individual overcurrent protection of solid state inverter devices.
  - 9. Output overvoltage trip.
  - 10. Loss of input phase, phase reversals, or blown fuse.
  - 11. Thermal overload trip for overload protection of solid state devices.
  - 12. Ground fault protection on start-up.
  - 13. Output line to line short circuit protection.
  - 14. Phase to phase short circuit or severe overload conditions of output.
  - 15. Overload of motor.
  - 16. Frequency stall.
  - 17. DC buss high voltage.
  - 18. Control function error.
  - 19. Heatsink over temperature (Max. operating ambient: 122 degrees F)
  - 20. Controller able to operate without a motor or any other equipment connected to the output (To facilitate startup and troubleshooting).
  - 21. Capable of restarting into a rotating motor without component damage.
  - 22. Shut down safely without component failure in the event of a sustained power loss, and will automatically return to normal operation, if start is "on" and power is restored.
  - 23. Shut down safely without component failure in the event of a momentary power loss. Automatically return to normal operation if the start is "on", and normal power is restored. Capable of establishing speed control without shutdown or component failure.

24. Designed for input power contactor opening or closing while control is activated, without damage to the controller.
25. Automatically reset trip resulting from overcurrent, undervoltage, overvoltage, or over temperature, and automatically restart after removal, or correction of the faulty condition.
26. Provide status lights or digital display for indication of failure conditions, and form C relay provided for remote indication. Digital display or status lights to indicate power on, at speed, and drive enabled.
27. Operation and fault diagnostic function circuits shall be built into each inverter that provides information in determining the cause and source of a fault. Diagnostics to provide the following information:
  - a. Operating mode at trip (Accel, Decel, Constant speed).
  - b. Output current at trip.
  - c. Output voltage at trip.
  - d. Additional faults that occurred simultaneously or immediately before displayed tripped.Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
28. DC link reactor.
29. Input power disconnect, lockable type.
30. Input power disconnect switch / circuit breaker, with lockable type handle.

## 2.5 OPERATOR DEVICES

- A. The following operator devices shall be door or remote mounted:
  1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
  2. Power on indication light.
  3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
  4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
    - a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
    - b. In manual (hand) mode, controller shall follow speed signal set via door mounted keypad and start/stop switch. Switching from "hand" to "auto" and vice versa shall require a single keystroke to a dedicated changeover key. Inverters requiring multiple keystrokes and/or reprogramming of internal parameters to accomplish changeovers are not acceptable.
    - c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.
  5. Programmable lockout code to prevent unauthorized programming.
  6. Critical frequency avoidance capability (up to 3 resonant points).

## 2.6 FIELD ADJUSTMENTS

- A. The following shall be adjustable in the field:
  1. Maximum Speed: 0 to 125% adjustable.
  2. Minimum Speed: 0 to 100% adjustable.
  3. Acceleration/deceleration rates: 0 to 3600 sec.
  4. Instantaneous overcurrent trip: 50% to 2000%.
  5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
  6. Current limit circuit: 60 to 100%.
  7. Carrier frequency: 6 to 16 KHZ.
  8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.
  9. Control signal Bias: 0 to 80 HZ.
  10. Control signal gain: 0 to 80 HZ.
  11. Calibration of remote speed signal: 0 to 80 HZ.

## 2.7 ELECTRICAL CONSTANT SPEED BYPASS

### VARIABLE FREQUENCY INVERTER

- A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
  - 1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
    - a. "Inverter" Mode connects the motor to the output of the inverter.
    - b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
    - c. "Off" Mode disconnects motor from all input power.
  - 2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
  - 3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
  - 4. A thermal overload to provide protection of motor in the bypass mode.
  - 5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – "inverter" or "bypass") in response to a signal from the thermal overload and/or external safety circuits.
  - 6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Installation as per manufacturer's recommendations and requirements.
  - 1. Inverter chassis is properly grounded.
  - 2. Line, Load, Control, and Fire/Safety wiring are installed in separate conduits.
  - 3. Length of wire between Motor and Variable frequency drive shall not exceed 100 feet.
  - 4. Install all electrical and control conduit into the bottom only of VFD cabinet. (No top or side cabinet penetrations)

#### 3.2 MANUFACTURER START-UP SERVICE

- A. Factory trained personnel shall be provided for start-up assistance, minimum (1) day per unit.
  - 1. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents.
  - 2. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.
  - 3. Adjustable devices, components, and assemblies to assure optimum performance.
  - 4. Make final adjustments to the installed drive to assure proper operation of the fan system. Obtain performance requirements from installer of driven loads.
  - 5. Assistance will be provided to the Owner (upon request) to determine the optimum capacitance for per factory correction and avoidance of potential resonance problems and will determine optimum line filter required.
  - 6. A written report, duly signed by the technician detailing set points of adjustable devices, amperages recorded, and any other pertinent data. This information is to be included in the operation and maintenance manual.
- B. Input DC voltage to dry motor windings when motor is not in operation at all locations.

#### 3.3 DEMONSTRATION AND TRAINING

- A. Provide system demonstration to personnel, Owner, and/or Owner's selected representatives. Provide training plan in writing to owner.
- B. Demonstrate operation of controllers in the automatic and manual modes.
- C. Provide a minimum of two days of technical training for the owner's operating and technical staff.

### VARIABLE FREQUENCY INVERTER

Schedule training with Owner's authorized representatives, during normal business hours and not less than 30 days prior to planned session.

- D. Training may be consecutive or random, at Owner's option.

END OF SECTION



SECTION 23 05 19

HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 23, Mechanical
  - 1. 23 05 00 - Mechanical General Provisions
  - 2. 23 20 00 - Pipe and Pipe Fittings, General
  - 3. 23 05 23 - Valves, Strainers and Vents
  - 4. 23 21 13 - Hot Water and Chilled Water Piping, Valves and Appurtenances

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Terice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1% over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: LF44S-1B or equal.

2.3 THERMOMETER WELLS

HVAC PRESSURE AND TEMPERATURE INSTRUMENTS



- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50% into pipe.

#### 2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9" scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections.
- H. Accuracy: +/- 1% of scale range.
- I. Range:
  - 1. Hot water lines: 30°F to 240°F.
  - 2. Chilled water lines: 0°F to 100°F or 120°F

#### 2.5 PRESSURE AND TEMPERATURE TEST STATIONS

- A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel.
  - 1. Fitted with a color coded cap strap with gasket.
  - 2. Acceptable Manufacturer: Peterson Equipment Company.
  - 3. Provide with extension neck to match insulation thickness.
- B. Provide to the Owner a fitted case with:
  - 1. Two 0-100 psi pressure gauges as specified and adapters with 1/8" OD probe.
  - 2. Four 5" stem pocket testing thermometers.
    - a. Two with range 25°F to 125°F for chilled water and condenser water.
    - b. Two with range 0°F to 220°F for hot water.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge.
- C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, chiller cooler and condenser, storage tanks, heat exchangers.
- E. Test wells for automatic temperature controls shall be furnished by Building Management Control Section and installed by Mechanical Contractor.

- F. Install thermometer in the following locations: Across chiller cooler and condenser, storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, common chilled and hot water lines.
1. Hot water lines: 30°F to 240°F.
  2. Chilled water lines: 0°F to 100°F or 120°F

END OF SECTION



SECTION 23 05 23

HVAC VALVES, STRAINERS AND VENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. HVAC Valves
- B. Pipe strainer and suction diffusers.

PART 2 – PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
  - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
  - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
- B. Butterfly Valves
  - 1. Butterfly valves shall conform to MSS-SP67.
  - 2. Liners, inserts and discs shall be suitable for the intended service.
  - 3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
- C. Balancing Valves
  - 1. Provide balancing valves with:
    - a. Corrosion resistant plug with resilient seal when required.
    - b. O-ring stem seal.
    - c. Permanently lubricated, corrosion resistant bearings.
  - 2. Connections
    - a. Through 2" pipe size use threaded connections.
    - b. For valves 2-1/2" pipe size and larger shall be provided with 150 psig flange connections.
  - 3. Provide each valve with:
    - a. Memory stop.
    - b. Plastic drip cap.
    - c. 1/8" gauge tap.
- D. Ball Valves
  - 1. Provide ball valves with:
    - a. Blowout proof stem.
    - b. Full size port, 316 stainless steel ball and stem.
    - c. Cast bronze body.
    - d. Threaded ends.
  - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
  - 3. Service rating:
    - a. 150 psi saturated steam.
    - b. 600 psi WOG.
  - 4. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. Provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.
  - 5. Provide with memory stop for balancing valves.
- E. Valve Connections
  - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
  - 2. Thread pipe sizes 2" and smaller.
  - 3. Flange pipe sizes 2-1/2" and larger.

HVAC VALVES, STRAINERS AND VENTS

4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

F. Valve Operators

1. Where butterfly valves are provided:
  - a. Provide gear operators on valves 6" and larger.
  - b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
  - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
  - d. Provide worm gear operators on discharge side of pumps for balancing, for all sizes of valves.
  - e. All valves 2-1/2" and larger provided by Milwaukee Valve shall be provided with gear operators.

G. Acceptable Manufacturers

1. Dezurik
2. Crane
3. Nibco
4. Keystone
5. Kitz (Hot Water Only)
6. Milwaukee Valve
7. Keckley

H. Check Valves

1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
3. Acceptable Manufacturers
  - a. Mission Duocheck
  - b. Nibco
  - c. Keystone
  - d. Milwaukee Valve
  - e. Keckley

K. Provide valves of same manufacturer throughout where possible.

L. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

M. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

N. Provide valve, seat and trim materials suitable for the intended service.

O. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, caged or ball type.

## 2.2 PIPE SYSTEMS STRAINERS

A. Body:

1. "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:

1. 2" size and smaller with screw connections rated 400 psi WOG.

## HVAC VALVES, STRAINERS AND VENTS

2. Over 2" size with flanged connections, rated 125 psi WOG.
- C. Fabricate screens of Monel or type 304 stainless steel:
  1. With 20 mesh woven wire in piping systems through 2".
  2. With 0.045 perforations in piping systems 2-1/2" and 3".
  3. With 0.125 perforations in piping systems 4" and larger.
- D. Start-up:
  1. Provide an additional fine mesh disposable screen for use during start-up operations.
  2. Remove after 30 days.
  3. Attach to piping for owners review.
- E. Acceptable Manufacturers
  1. Crane
  2. Zurn
  3. Mueller
  4. Armstrong
  5. Bell & Gossett
  6. Keckley

## 2.3 SUCTION DIFFUSER

- A. For each pump as shown on the drawing, provide an angle type suction diffuser. Body is to fit both the pump inlet and suction pipe size.
- B. Components:
  1. Inlet straightening vanes.
  2. Removable end cap.
  3. Gauge ports.
  4. Threaded strainer blow down port.
  5. Adjustable support foot.
  6. Removable magnetic insert.
- C. The screen shall be as specified for pipe system strainers.
- D. Provide an additional fine mesh disposable strainer for use during start up operations.
  1. Remove after 30 days operation and all flushing is complete.
  2. Attach to piping for owners review.
- E. Construction:
  1. 2" size and smaller with screw connections rated 400 psi WOG.
  2. Over 2" size with flanged connections, rated 125 psi WOG.
- F. Fabricate screens of Monel or type 304 stainless steel:
  1. With 20 mesh woven wire in piping systems through 2".
  2. With 0.045 perforations in piping systems 2-1/2" and 3".
  3. With 0.125 perforations in piping systems 4" and larger.

## 2.4 VALVE SCHEDULE

- A. Hydronic Service
  1. Chilled Water Service
    - a. Ball Valves up to 2": Nibco T-585-70-66 w/Nib-Seal insulated Handle
    - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000  
Keystone Figure 222
  2. Heating & Condenser Water Service
    - a. Ball Valves up to 2": Nibco T-585-70-66
    - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000  
Keystone Figure 222
  3. Check Valve:
    - a. Nibco Check Valve: T - 413 - B
    - b. Nibco Check Valve 2-1/2" and larger: F - 918 - B

### HVAC VALVES, STRAINERS AND VENTS

- c. Nibco Check Valve 2-1/2" and larger: W - 920 -W (Wafer)
- d. Keystone Check 2-1/2" and larger: FIQ 810

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in circulating water systems, for balancing duty. Provide infinite position gear operator with memory stop.
- D. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
  - 1. 1" valve for pipes 6" and larger.
  - 2. 3/4" valve for pipes smaller than 6".
  - 3. Terminate with pipe plug.
  - 4. Drain valves shall be ball valves.
- E. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- F. Provide clearance for installation of insulation and access to valves.
- G. Provide access where valves are not exposed.
- H. Float valves / stilling wells provided and installed in cooling tower or condenser water basins for water level control. Stilling wells provided around float to prevent turbulence ripples or wind from interference.

#### 3.3 PIPE SYSTEMS STRAINERS

- A. Provide an additional fine mesh disposable strainer for use during start up operations.
  - 1. Remove after 30 days operation and all flushing is complete.
  - 2. Attach to piping for owners review.
- B. Provide strainer in supply piping for all coil connections.
- C. Provide strainer in condenser water piping outside near pump and after pump discharge.

#### 3.4 WATER SYSTEM AIR VENTS

- A. Provide manual air vents at high points and at any other air pockets of closed circulating pipe systems. Extend 3/8" hard drawn copper tubing discharge drains to nearest floor or hub drain. Provide 1/4" Ball Valve as specified.
- B. Where high point vents are not readily accessible provide additional valves at vent termination.

END OF SECTION

SECTION 23 05 33

HVAC PIPE HEAT TRACING

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.
- B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

- A. Submit shop drawings and product data as specified in Section 23 05 12
- B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.
- C. Submit manufacturer's certified capacity charts with selections plotted thereon.
- D. Submit manufacturer's installation instructions.
- E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raychem Corporation
- B. Thermon Manufacturing Company

2.2 COMPONENTS

- A. Self-regulating heater.
  - 1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
  - 2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
  - 3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
  - 4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
  - 5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
  - 6. Power connection, end seal, splice and tee kits components shall be applied in the field.
  - 7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
  - 8. Provide an end-of-circuit voltage indicating light

PART 3 – EXECUTION

HVAC PIPE HEAT TRACING



### 3.1 INSTALLATION

- A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.
- B. Install the pipe heat tracing cable under the pipe insulation.
- C. Apply "Electrically Traced" signs to the outside of the thermal insulation.
- D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
- E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
- F. Use only electrical components as recommended by the manufacturer.

### 3.2 ELECTRICAL WORK

- A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
- B. The specified wiring work includes:
  - 1. Wiring of control instruments between thermostat and junction boxes
  - 2. Installation of thermostat and junction boxes
  - 3. Wiring from the heat tracing cable to the junction boxes
- C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
- D. Provide devices and appurtenances as specified in Division 26.
- E. Identify each circuit at each terminal with a separate tag.
- F. Color code wires in accordance with IPCEA Standards.
- G. Make all joints and connections with approved mechanical connectors.

### 3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

- A. Test the pipe heat tracing system:
  - 1. Simulate freezing outside air conditions
  - 2. Measure the amperage draw of the heat tracing system
  - 3. Compare to the manufacturer's capacity rating of the actual system
  - 4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.
- B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END OF SECTION

SECTION 23 05 48

VIBRATION ISOLATION

PART 1 – GENERAL

1.1 SCOPE

- A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

- A. Division 23 Mechanical.
  - 1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
  - 2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

- A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amber Booth
- B. Kinetics
- C. Mason
- D. Korfund
- E. VSI.
- F. Vibration Eliminator Co., Inc.
- G. Metraflex

2.2 ISOLATOR TYPES

- A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.
- B. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.
- C. Flexible spherical expansion joints shall employ Peroxide cured EPDM in the covers, tubes and frictioning of the reinforcement. Reinforcement must be DuPont Kevlar. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. No substitutions for the DuPont Kevlar or the solid steel embedded flange rings are acceptable. Sizes 2 inch (50mm) and larger shall have two spheres reinforced with a metal ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 inch (400mm) to 24 inch (600mm) may be single sphere. Sizes 3/4 inch (20mm) to 1-1/2 inch (40mm) may have threaded bolted flange assemblies, one

VIBRATION ISOLATION

sphere and cable retention. 14 inch (300mm) and smaller connectors shall be rated at 250 psi (17 BAR) up to 190°F (88°C) with a uniform drop in allowable pressure to 190 psi (13 BAR) at 250°F (121°C). 16 inch (400mm) and larger connectors are rated 180 psi (12 BAR) at 190°F (88°C) and 135 psi (9 BAR) at 250°F (121°C). Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints. High pressure joints shall be substituted for the above where operating pressures are higher than standard. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. Control rods are not desirable in seismic work. If control rods are used, they must have ½- inch (12mm) thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi (6.9 N/mm<sup>5</sup>) maximum on the washer area. Standard diameter bolt washers are not acceptable.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

Flexible expansion joint device shall be provided with a 5-year warranty against leaks and failure.

### 2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Chiller	A	0.35"
Condensing Units	A	0.35"
In-Line Fans	B	0.5"

### 2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	C
Suspended Pumps	C
Chiller Pipe Connections	C

### 2.5 FLEXIBLE CONNECTIONS IN PIPING AT PUMPS

- A. Provide flexible connections at suction and discharge of chilled water, and hot water pumps, piping connections on chillers and where indicated on drawings. Refer to schedule above.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.
- B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION

SECTION 23 05 93

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Balance, adjust and test the air distribution system including the exhaust system.
- B. Balance, adjust and test the hydronic system.
- C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

- A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

- A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

- A. History of the TAB organization.
- B. Agency certification.
- C. Personnel qualifications.
- D. TAB data forms.
- E. Instrumentation list.
- F. Name of the project supervising engineer.
- G. Name and address and contact person of five successfully completed projects of similar size and scope.
- H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

- A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
- B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.
- C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
- D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.
- E. The balancing agency shall have operated for a minimum of five years under its current name.
- F. Personnel:
  - 1. The project supervisor shall be a Professional Engineer registered in Texas.

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

- a. Extensive knowledge of the work involved.
  - b. At least five years experience conducting tests of the type specified.
  - c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
2. All work shall be conducted under the direct supervision of the supervising engineer.
3. Technicians shall be trained and experienced in the work they conduct.

#### 1.6 WARRANTY

- A. Provide (AABC) guarantee in writing.
- B. Extended warranty.
  1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
  2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
  3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

#### PART 2 - PRODUCTS - NOT USED

#### PART 3 – EXECUTION

##### 3.1 TAB TOLERANCES

- A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

##### 3.2 SITE VISITS

- A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.
- B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.
- C. Note proper piping installation, location of valves, and flow measuring instruments.
- D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.
- E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

##### 3.3 TESTING INSTRUMENTS

- A. Submit a list of all instruments to be used for the test and balance procedures.
  1. Catalog sheets
  2. Certificate of last calibration

#### TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

3. Calibration within a period of six months prior to balancing

- B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

### 3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

- A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.
- B. Make tests to verify proper placement of the static pressure sensors for the variable air volume fan system control.
- C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
  1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
  2. Verify that all control devices are properly connected.
  3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
  4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
  5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
  6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
  7. Observe the calibration of all controllers.
  8. Verify the proper application of all normally opened and normally closed valves.
  9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
  10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
  11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
  12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
  13. Check all dampers for free operation.
  14. Verify that all controller setpoints meet the design intent.
  15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.
- D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineers office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

### 3.5 INSTRUMENT TEST HOLES

- A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
  1. Drill holes, plug and tape external duct insulation.
  2. Repair damaged insulation to Engineer's approval.

### 3.6 TESTING THE AIR DISTRIBUTION SYSTEM

- A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been

## TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

installed per design and set full open. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:

1. Supply Fans:
    - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
    - b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
    - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
    - d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.
    - e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.
  2. All Other Fans:
    - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
    - b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
    - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
    - d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.
  3. VAV Terminal Units:
    - a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
    - b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
  4. Diffusers, Registers and Grilles:
    - a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
  5. Coils (including electric coils):
    - a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.
- B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.
- C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.
- D. Where air measuring stations are installed, use pitot tube traverse readings to verify and record the correct calibration of the stations output.
- E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

- F. Measure and adjust all supply and return branches to design air delivery.
- G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.
- H. Make a set of recordings showing final system conditions.

### 3.7 TESTING THE HYDRONIC SYSTEMS

- A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
  - 1. Record preliminary pump data.
    - a. Pump RPM.
    - b. Pump shut-off differential head.
    - c. Pump operating differential head.
    - d. Check and verify pump alignment.
    - e. Verify impeller diameter.
- B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.
- C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.
- D. Balance flow through:
  - 1. Chillers.
  - 2. Coils.
  - 3. Boiler.
  - 4. Pumps
  - 5. Condensers.
  - 6. Cooling tower.
  - 7. Heat Exchanger.
- E. Use flow meters, differential pressures and temperature relationships as required.
- F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.
- G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.
- H. Pumps:
  - 1. Test and adjust pumps to meet design water flow requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations. Check and verify pump alignment.
  - 2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.
- I. Coils:
  - 1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
  - 2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.
- J. Boilers:
  - 1. Verify that boilers have been filled and started by others, and are in operation.
  - 2. Current and Voltage: As applicable, test and record motor voltage and amperage, and

### TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS



compare data with the nameplate limits to ensure motor is not in or above the service factor.

3. Test, adjust and record water flows through water boilers.
4. Test and record water temperature profiles of each boiler.

K. Chillers:

1. Verify that chillers have been started by the manufacture and are in operation. Test and adjust chiller water flows to within 5% of the design requirements by using a U-TUBE manometer and setting balancing valves.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.
3. Test and record temperature profiles of each chiller at design water flow.

L. Cooling towers:

1. Verify that cooling towers have been filled and started by others and are in operation.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure cooling tower fan motor is not in or above the service factor.
3. Test and adjust water flows to balance tower cells and flows between towers.
4. Test and record water temperature profiles of each condenser at design water flow for water and air side operation.

M. Heat exchangers:

1. Verify that heat exchangers have been filled and started by others, and are in operation.
2. Test and record temperature and pressure profiles of water and steam heat exchangers.

### 3.8 EQUIPMENT POWER READINGS

A. Record the following information for each motor:

1. Equipment designation.
2. Manufacturer.
3. Unit model number and serial number and frame.
4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
5. Heater coil in starter.
  - a. Rating in amperes.
  - b. Manufacturer's recommendation.
6. Motor RPM/driven equipment RPM.
7. Power reading (voltage, amperes of all legs at motor terminals).

### 3.9 BOILERS

A. Check for proper operation and with operation at near design conditions, record the following:

1. Manufacturer, model number, serial number and nameplate.
2. If water type, water flow in GPM, entering and leaving water temperature and water pressure drop in feet.
3. Type of fuel and heating value.
4. Rate of fuel consumption.
5. Capacity in MBH.
6. Efficiency.
7. Flue gas analysis.
8. Motor data.

B. Observe demonstration that all controls and safety devices are functioning properly. Record observations.

### 3.10 CHILLERS (Water Cooled)

A. Balance flow of water thru each evaporator and condenser to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.

B. Verification of safety interlocks and controls are the responsibility of the manufacturer.

## TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

- C. With each chiller operating at near design temperature and water flow conditions, measure and record the following:
  - 1. Manufacturer, model number, serial number and all nameplate data.
  - 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
  - 3. Condenser water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
  - 4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
  - 5. Volts and amps for each phase.
  - 6. Power factor.
  - 7. KW input.
  - 8. Tons of cooling.
  - 9. KW per ton of cooling.
- D. Reference chiller specification for additional requirements.

### 3.10 CHILLERS (Air Cooled)

- A. Balance flow of water through each evaporator to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.
- B. Verification of safety interlocks and controls are the responsibility of the manufacturer.
- C. With each chiller operating at near design temperature conditions, measure and record the following:
  - 1. Manufacturer, model number, serial number and all nameplate data.
  - 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
  - 3. Condenser air entering temperature, leaving temperature.
  - 4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
  - 5. Volts and amps for each phase.
  - 6. Power factor.
  - 7. KW input.
  - 8. Tons of cooling.
  - 9. KW per ton of cooling.
- D. Reference chiller specification for additional requirements.

### 3.11 TESTING THE VARIABLE AIR VOLUME SYSTEM

- A. All VAV boxes used are to be calibrated to produce the rated air quantity.
- B. Set and record the supply air static pressure controller to provide actual design air flow at the most resistive terminal.
- C. Measure and adjust the design air delivery at the inlet of each VAV box.
- D. Measure and record the air quantity from each VAV box at its maximum flow. Manipulate the controller to achieve maximum flow.
- E. Reset each box to yield and record minimum primary air flow.
  - 1. DDC controllers record the correction factor required to establish actual desired air quantity as designed.
  - 2. Pneumatic controllers adjust velocity controller as required to establish actual desired air quantity as designed.
- F. If the box is operating with inlet static pressure in excess of the minimum cataloged pressure specified by the manufacturer and is not producing rated air quantity, field adjust the box to

### TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

produce rated air quantity. Retest until approved results are obtained.

- G. Position the VAV boxes to the proportion of maximum fan air volume to total installed box maximum volume.
- H. Set the fan to deliver the AHUs scheduled design airflow.
- I. Perform and record a total air traverse.
- J. With the system terminal boxes set for full flow or diversity, the system will be delivering the scheduled design CFM with the most restrictive box in control. Make a speed increase if either or both static and volume are low.
- K. Set the boxes to minimum and adjust the inlet vanes and or speed controllers to prevent excessive static in the system.
- L. Coordinate with the work specified in Building Management and Control System on the final location of the sensors for the static pressure controller. Locate in the supply duct far enough from the fan discharge to be truly representative of the average static pressure in the system.
- M. Modulate the fan speed on the supply fan. Adjust as required to coordinate with the static pressure sensing network.
- N. Make a set of recordings showing final system conditions including system duct static pressures and control system setpoint.

### 3.12 DUCT TEST

- A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

### 3.13 DIRECT EXPANSION EQUIPMENT

- A. With each unit operating at near design conditions, measure and record the following:
  - 1. Manufacturer, model number, serial number and all nameplate data.
  - 2. Ambient temperature, condenser discharge temperature.
  - 3. Amperage and voltage for each phase.
  - 4. Leaving and entering air temperatures.
  - 5. Suction and discharge pressures and temperatures.
  - 6. Tons of cooling.
  - 7. Verification that moisture indicator shows dry refrigerant.

### 3.14 TAB REPORT

- A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.
- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.
- C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
  - 1. Title Page
    - a. Company Name

## TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

- b. Company Address
  - c. Company telephone number
  - d. Project name
  - e. Project location
  - f. Project Manager
  - g. Project Engineer
  - h. Project Contractor
  - i. Project Identification Number
- 2. Summary of the TAB report data
- 3. Index
- 4. Instrument List
  - a. Instrument
  - b. Manufacturer
  - c. Model
  - d. Serial Number
  - e. Range
  - f. Calibration Date
  - g. What test instrument is to be used for:
- 5. Fan Data
  - a. Location
  - b. Manufacturer
  - c. Model
  - d. Air flow, specified and actual
  - e. Total static pressure (total external) specified and actual
  - f. Inlet pressure
  - g. Discharge pressure
  - h. Fan RPM
- 6. Return Air/Outside Air Data
  - a. Identification/location
  - b. Design return air flow
  - c. Actual return air flow
  - d. Design outside air flow
  - e. Actual outside air flow
  - f. Return air temperature
  - g. Outside air temperature
  - h. Required mixed air temperature
  - i. Actual mixed air temperature
- 7. Electric Motors
  - a. Manufacturer
  - b. HP/BHP
  - c. Phase, voltage, amperage, nameplate, actual
  - d. PM
  - e. Service Factor
  - f. Starter size, heater elements, rating
- 8. V-Belt Drive
  - a. Identification/location
  - b. Required driven RPM
  - c. Drive sheave, diameter and RPM
  - d. Belt, size and quantity
  - e. Motor sheave, diameter and RPM
  - f. Center-to-center distance, maximum, minimum and actual
- 9. Duct Traverse
  - a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air correction factor
- 10. Air Monitoring Station Data

- a. Identification/location
  - b. System
  - c. Size
  - d. Area
  - e. Design velocity
  - f. Design air flow
  - g. Test velocity
  - h. Test air flow
11. Air Distribution Test Sheet
  - a. Air terminal number
  - b. Room number/location
  - c. Terminal type
  - d. Terminal size
  - e. Correction factor
  - f. Design velocity
  - g. Design air flow
  - h. Test (final) velocity
  - i. Test (final) air flow
12. Pump Data
  - a. Identification/number
  - b. Manufacturer
  - c. Size/model
  - d. Impeller
  - e. Service
  - f. Design flow rate, pressure drop, BHP
  - g. Actual flow rate, pressure drop, BHP
  - h. Discharge pressure
  - i. Suction pressure
  - j. Total operating head pressure
  - k. Shut off, discharge and suction pressures
  - l. Shut off, total head pressure
  - m. Pressure differential settings
13. Cooling Coil Data
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Entering air DB temperature, design and actual
  - f. Entering air WB temperature, design and actual
  - g. Leaving air DB temperature, design and actual
  - h. Leaving air WB temperature, design and actual
  - i. Water pressure flow, design and actual
  - j. Water pressure drop, design and actual
  - k. Entering water temperature, design and actual
  - l. Leaving water temperature, design and actual
  - m. Air pressure drop, design and actual
  - n. Capacity - sensible and latent
14. Heating Coil Data
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Entering air DB temperature, design and actual
  - f. Leaving air DB temperature, design and actual
  - g. Water pressure flow, design and actual
  - h. Water pressure drop, design and actual
  - i. Entering water temperature, design and actual
  - j. Leaving water temperature, design and actual
  - k. Air pressure drop, design and actual
  - l. Capacity
15. Electric Coil Data
  - a. Identification/number

- b. Location
- c. Service
- d. Manufacturer
- e. Entering air DB temperature, design and actual
- f. Leaving air DB temperature, design and actual
- g. Electrical Characteristics
- h. Capacity
- 16. Sound Level Report
  - a. Location (Location established by the design engineer)
  - b. N C curve for eight (8) bands-equipment off
  - c. N C curve for eight (8) bands-equipment on
- 17. Vibration Test on equipment having 10 HP motors or greater in size.
  - a. Location of points:
    - 1) Fan bearing, drive end
    - 2) Fan bearing, opposite end
    - 3) Motor bearing, center (if applicable)
    - 4) Motor bearing, drive end
    - 5) Motor bearing, opposite end
    - 6) Casing (bottom or top)
    - 7) Casing (side)
    - 8) Duct after flexible connection (discharge)
    - 9) Duct after flexible connection (suction)
  - b. Test readings:
    - 1) Horizontal, velocity and displacement
    - 2) Vertical, velocity and displacement
    - 3) Axial, velocity and displacement
  - c. Normally acceptable readings, velocity and acceleration
  - d. Unusual conditions at time of test
  - e. Vibration source (if non-complying)
- 18. Control verification indicating date performed and any abnormalities identified.
  - a. Point Location/Description
  - b. EMS Readout (Setpoint and Actual)
  - c. Actual Readout of all points
  - d. Interlocks
  - e. Safeties
  - f. Variable speed drive tracking with EMS input
  - g. Variable speed drive Bypass operation
  - h. Sequence of operation

END OF SECTION



SECTION 23 05 94

COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

- A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
- B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION

3.1 COORDINATION

- A. Bring the work to a state of readiness for testing, balancing, and adjusting.
  - 1. Install air terminal devices.
  - 2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
  - 3. Verify lubrication of equipment.
  - 4. Install permanent instrumentation.
  - 5. Clean piping systems and fill with clean water.
  - 6. Complete "Start-up" of equipment.
  - 7. Check rotation and alignment of rotating equipment and tension of belted drives.
  - 8. Verify ratings of overload heaters in motor starters.
  - 9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
  - 10. Provide control diagrams and sequence of operation.
  - 11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
  - 12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
  - 13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
  - 14. Comb out fins on extended-surface heat transfer coils where damaged.
  - 15. Clean all strainers as required.
  - 16. Remove construction strainers after water is cleaned and treated.
  - 17. Remove all temporary filters from HVAC equipment.
  - 18. Provide start-up reports listing all start-up information and manufacturer's information attached.
- B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
- C. Verify that the systems are ready for balancing and adjusting.
- D. Submit a letter stating:
  - 1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
  - 2. Other equipment has been checked and started.
  - 3. The systems have been operated for the specified period of time.
  - 4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.
- E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.
- F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.

COORDINATION OF TESTING AND BALANCING



- G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

- A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.
- B. Complete start-up of equipment prior to start of testing & balancing.
- C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

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END OF SECTION



SECTION 23 07 13

EXTERNAL DUCT INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install external insulation on supply, return and outside air ductwork.
- B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

- A. Division 9 - FINISHES. Painting and Color Coding.
- B. Division 23 - MECHANICAL.
  - 1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
  - 2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
  - 3. Insulation. Refer to specific sections on individual insulation types.
  - 4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
- C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated system is not approved.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

- A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.
- B. Sample Application. Make an application of each type of insulation to display the material, quality

EXTERNAL DUCT INSULATION

and application method. Obtain approval of the sample application before proceeding with installation of the work.

## PART 2 – PRODUCTS

### 2.1 INSULATION

- A. Glass fiber rigid duct insulation.
  - 1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
  - 2. Acceptable Manufacturers
    - a. Schuller 814 spin-glas FSK.
    - b. Owens-Corning Type 703 board RKF.
    - c. Knauf 3 PCF FSK.
- B. Glass fiber blanket duct insulation.
  - 1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
  - 2. Acceptable Manufacturers
    - a. Manville R-series Microlite FSKL.
    - b. Owens-Corning ED100 RKF.
    - c. Knauf 1.0 PCF FSK.
- C. Fiberglass reinforcing cloth mesh.
  - 1. Acceptable Manufacturers
    - a. Perma Glass Mesh.
    - b. Alpha Glass Mesh.
    - c. Childers Chil-Glas #10
    - d. Foster Mast a Fab
    - e. Vimasco.
- D. Mastics, sealants, coatings and adhesives.
  - 1. Acceptable Manufacturers
    - a. Childers.
    - B. Foster.
    - c. Vimasco.
- E. Fireboard Insulation
  - 1. Totally encapsulated with foil facing.
  - 2. Two hour rated fire protection.
  - 3. Zero clearance to combustible protection.
  - 4. System shall be listed and labeled by an NRTL.
  - 5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
  - 6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
  - 7. Acceptable Manufacturers
    - a. Unifrax ON Fyrewrap Elite 1.5
    - b. Partak Insulation, Inc. Paroc Fireboard
    - c. Thermal Ceramics FireMaster 3M
    - d. Premier Refractories International, Pyroscat.
- F. Rigid Closed Cell Insulation
  - 1. Acceptable Manufacturers
    - a. Dow Trymer.
    - b. Phenolic Foam.
- G. Reinforced Foil Tape
  - 1. Acceptable Manufacturers

- a. Venture 1525CW
- b. 3" FSK
- 2. Thickness 6.5 mils
- 3. Color: silver

## 2.2 COATING AND ADHESIVE

- A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249.
- C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
- D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

## 2.3 OUTDOOR DUCT LAMINATED JACKETING

- A. Rubberized bitumen compound material:
  - 1. Ultraviolet resistant
  - 2. Weatherproof
  - 3. Vapor retarding jacketing
  - 4. Laminated jacketing
  - 5. Cross-laminated high strength polyethylene film
  - 6. Laminated to aluminum foil
  - 7. Minimum 60-mil thickness
- B. Acceptable Manufacturers:
  - 1. Alumaguard 60
  - 2. Flex Clad 400
  - 3. Venture Clad 1577CW

## PART 3 - EXECUTION

### 3.1 FIRE SAFETY REQUIREMENTS

- A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

### 3.2 CONCEALED DUCT

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.
- B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2" thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.
- D. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward clinch steel staples on 2" centers and taped using 3" wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.

## EXTERNAL DUCT INSULATION

- E. Ductwork in mechanical rooms is considered concealed spaces.

### 3.3 EXPOSED DUCT INSULATION

- A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
  - 1. Apply fabric and mastic to provide a smooth surface for painting.
- B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.
- D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

### 3.4 OUTDOOR DUCTWORK COVERING

- A. Cover all supply and return ductwork outdoors:
  - 1. 1-1/2" thick, rigid closed cell insulation with reinforced foil facing.
- B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.
- C. Impale the insulation over mechanical fasteners and washers.
  - 1. A minimum of 2 rows of fasteners per side on 12-inch centers.
  - 2. Seal all breaks, joints and punctures by applying a 1/8" thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.
- D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4".
- E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
  - 1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4".
  - 2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8".
  - 3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
  - 4. Aluminum gray or white finish as approved by the Architect.
- F. Standing water on horizontal surfaces is not approved.
- G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

### 3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

- A. Secure fireboard insulation to duct with impaling pins and 3" square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for

#### EXTERNAL DUCT INSULATION

inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12" centers.

3.6 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Apply insulation on clean, dry surfaces only.
- C. Continue insulation with vapor barrier through penetrations.
- D. Neatly finish insulation at supports, protrusions and interruptions.
- E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.
- F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.
- G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION





SECTION 23 07 16

VESSEL INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install insulation for both high and low temperature vessels.
- B. Low temperature installations include expansion tanks, air eliminators, chiller nozzles, chiller heads and other vessels containing liquids 60°F and below.
- C. High temperature installations include expansion tanks, air eliminators, domestic water storage tanks, boiler stack / transition and other vessels containing liquids above 60°F.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All vessel insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated vessel system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation, also repair any damage caused by the condensation.
- F. Where existing insulated vessel, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

VESSEL INSULATION

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1.4 RELATED WORK

- A. Division 9 Finishes. Painting and color-coding

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe & tank insulation:
1. Schuller Type 817
  2. Owens-Corning Type 705
  3. Knauf 2.8 PCF
- B. Closed cell, non-wicking pipe & tank insulation:
1. Armaflex FS, 2" thickness
- C. Aluminum Jacketing:
1. Childers
  2. Pabco
  3. RPR
- D. Monel Staples
1. Bostich Monel
  2. Duo-Fast Monel
  3. Markwell Monel
- E. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
  2. Alpha Glass Mesh
  3. Childers Chil-Glas
  4. Foster Mast a Fab
- F. Weather Resistant Coating:
1. WB Armaflex Finish

2.2 CEMENT, MASTICS, SEALANTS, ADHESIVES AND COATINGS

- A. Adhesive: Provide Childers CP-127 or Foster 85-60 fiberglass adhesive to seal insulation for low temperature vessels.
- B. Adhesive / Joint Sealant: Provide Armaflex 520 adhesive to seal insulation for low and temperature vessels.
- C. Lagging Adhesive / Coating: Furnish Childers CP50AHV2 or Foster 30-36 lagging adhesive / coating to provide a finish coat and to secure finish cloth for high temperature vessels.
- D. Insulation Joint Sealant: Use Childers CP-76 or Foster 95-50 to seal the joints of insulation on low temperature vessels.
- E. Metal Jacketing Sealant: Use Childers CP-76 or Foster 95-44 on all metal jacketing laps outdoors.
- F. Vapor Barrier Coating: Indoors - Use Childers CP-38 or Foster 30-80 vapor barrier coating finish to coat the canvas finish on low temperature vessels. Permeance shall be 0.013 perms or less as tested by ASTM E96. Coating must comply with MIL-C-19565C, Type II and be QPL listed. Permeance shall be 0.03 perms or less at 30 mils, dry. Tested at 100°F and 90% RH per ASTM F 1249 and by Hypalon rubber based.
- G. Weather Barrier Mastic: Furnish Childers CP-10/11 or Foster 46-50 weather barrier mastic and

VESSEL INSULATION

reinforcing mesh for outdoor finish.

- H. Reinforcing Mesh: Furnish 10 X 10 white glass or polyester reinforcing mesh.

### PART 3 - EXECUTION

#### 3.1 HIGH TEMPERATURE VESSELS (FIBERGLASS)

- A. Apply a first layer of insulating board. Band the board on immediately after application, using bands on 12" centers, drawn tight and securely fastened.
- B. Apply successive layers of insulation as specified for the first layer, with joints staggered. After insulation has been applied, finish with Childers CP-38 or Foster 30-80 vapor barrier coating reinforced with glass or polyester reinforcing mesh per manufacturer's recommendations. Provide a flood coat of Childers CP-10/11 or Foster 46-50 with Foster Mast a Fab polyester or Chil Glas #10 reinforcing mesh.
- C. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with glass fiber wall cavity insulation.

#### 3.2 LOW TEMPERATURE VESSELS (CLOSED CELL)

- A. Apply a layer of insulating board. Band the insulation on immediately after application, using bands on 12" centers, drawn tight and securely fastened.
- B. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with closed cell insulation.
- C. Apply weather protective finish on closed cell insulation. Provide a minimum of three coats.

#### 3.3 ALUMINUM JACKETING (Insulated vessels outdoors above grade)

- A. Apply aluminum jacket on vessels according to manufacturer's recommendations using aluminum strapping and metal jacketing sealant to provide weather tight covering.
- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function.
- C. Install straps on 12" centers.

#### 3.4 VESSEL INSULATION REQUIREMENTS

- A. Insulate all low and high temperature vessels located exterior (outside) of the building, including the following:
1. Air separators
  2. Expansion Tanks
  3. Chemical feeders
  4. Chilled water system volume tanks
  5. Insulation thickness shall match thickness of adjoining pipe insulation
- B. Insulate all low temperature vessels located interior (inside of the building, including the following:

#### VESSEL INSULATION

1. Air separators
  2. Chemical feeders
  3. Chilled water system volume tanks
  4. Insulation thickness shall match thickness of adjoining pipe insulation
- C. Insulate the following high temperature vessels located interior (inside the building).
1. Air Separators
  2. Insulation thickness shall match thickness of adjoining pipe insulation
- D. As indicated on the drawings
- E. Expansion tanks, air separators, and volume tanks shall be provided with a access flap or removable section of insulation at vessel nameplate to provide access for inspections.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including chilled water, hot water, and condensate piping.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

- A. Finishes. Painting and color-coding
- B. Pipe Heat Tracing

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:

HVAC PIPING INSULATION

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1. Johns-Manville Micro-Lok AP-T
  2. Owens-Corning ASJ/SSL
  3. Knauf ASJ/SSL
- B. Cellular Glass Insulation (Foamglass):
1. Pittsburg Corning
  2. Cell-U-Foam
- C. Rigid Foam Insulation:
1. Koolphen - Phenolic Foam
  2. Dow Trymer
  3. Tarec Ecophen – Phenolic Foam
- D. Aluminum Jacketing:
1. ITW Lock-on (Childers)
  2. ITW Z-lock (Pabco)
- E. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
  2. Alpha Glass Mesh
  3. Childers Chil-Glas
  4. Foster Mast a Fab
  5. Vimasco
- F. Mastics, Sealants, Coatings and Adhesives
1. Childers
  2. Foster
  3. Vimasco
  4. Armstrong 520 Adhesive
- G. Elastomeric Insulation
1. Armacell
- H. Weather Resistant Coating
1. WB Armaflex Finish
  2. Foster 30-64
- I. Glass fiber blanket insulation
1. Manville R-series Microlite FSKL
  2. Owens-Corning eD75 or ED100 RKF
  3. Knauf 0.75 PCF FSK

## 2.2 RIGID FOAM PIPE INSULATION

- A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.
1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
  2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
  3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

## 2.3 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

## 2.4 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than 3/4" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less

when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

## 2.5 CELLULAR GLASS INSULATION

### A. ASTM C552:

1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

## 2.6 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
  2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

## 2.7 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.
- B. Vapor Barrier Finish:
1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
  2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
  3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.
- C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.
- D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.
- E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.
- F. Other products of equal quality will be acceptable only upon approval.

## 2.8 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

## 2.9 GLASS FIBER BLANKET INSULATION

### HVAC PIPING INSULATION



- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

### PART 3 – EXECUTION

#### 3.1 INTERIOR PIPING

- A. Cover all hot water piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Cover all chilled water piping with rigid foam insulation.
  - 1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
  - 2. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with 1/2" wide glass filament tape.
  - 3. Apply a tack coat of fitting mastic over the insulation and tape.
  - 4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
  - 5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
  - 6. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- C. Install hanger with protective shield, on the outside of all insulation.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
  - 1. Chilled water and heating water
  - 2. Make-up water

#### 3.2 REFRIGERANT AND CONDENSATE PIPING

- A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.
- B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.
- C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.
- D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

#### 3.3 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all chilled and hot water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
- D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
- F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

#### 3.4 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
  - 1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
  - 2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
  - 3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2" on adjoining sections of pipe insulation.
  - 4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
  - 5. Apply coating/mastic to a wet film thickness of 3/64".
  - 6. Fabric shall not be visible after completion.
  - 7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. PVC fitting covers are not acceptable.

#### 3.5 MISCELLANEOUS

- A. Insulate chilled water pumps with closed cell insulation box.
- B. Install materials after piping has been tested and approved.
- C. Apply insulation on clean, dry surfaces only.
- D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

#### 3.6 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>(Inches)</u>
Refrigerant Piping	1-1/2
Chilled Water Piping (through 2" pipe)	1-1/2
Chilled Water Piping (2-1/2" pipe and Larger)	2
Condensate Drains	1
Heating Water Piping 2" Pipe and Larger	2
Heating Water Piping 1-1/2" Pipe and Smaller	1-1/2
Exterior Chilled and Hot Water Piping, 5" Pipe and Larger	2

Exterior Chilled and Hot Water Piping 4" Pipe and Smaller

1-1/2

END OF SECTION

SECTION 23 08 00

HVAC SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

- A. The purpose of this Section is to define responsibilities in the Commissioning Process. Additional system testing is required within individual Specification Sections.
- B. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning requirements and coordination are detailed in Division 01. Division 20-25 Contractors shall be familiar with all parts of Division 01 and the Commissioning Plan issued by the Owner's CxA, shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- C. HVAC systems to be commissioned include the following:
  - 1. Chillers
  - 2. Boilers
  - 3. Pumps
  - 4. Air Handling Unit Systems
  - 5. DX Split Systems
  - 6. Air Terminal Units (10% Sampling)
  - 7. Fan Coil Units
  - 8. Exhaust and Supply Fan Systems
  - 9. Fire, Fire/Smoke and Volume Dampers (Review of testing documentation provided by the contractor)
  - 10. HVAC / Building Automation System and Integrations
  - 12. HVAC / Emergency Power Source Integrations
  - 13. HVAC / Life Safety Systems Integrations
- D. The TAB Contractor will perform control sequence verification on each terminal unit shall independently verify each sensor and point and document the results to be included in the Final TAB Report. The CxA will commission 10% of the terminal units once TAB is complete with the CSV and point verification of the terminal units.

1.3 DEFINITIONS

- A. Refer to the General Commissioning Requirements for definitions.

1.4 SUBMITTALS

- A. Contractor shall provide Owner and/or CxA with documentation required for Commissioning Work. At minimum, documentation shall include: Detailed Start-up procedures, full sequences of operation, Operating and Maintenance data, performance data, control drawings, and details of Owner-contracted tests.
  - 1. Shop drawings and product submittal data related to systems or equipment to be commissioned.

HVAC SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

- B. Contractor shall submit to Owner and/or CxA installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- C. Where installation testing may be performed in a progressive manner (i.e., piping hydrostatic testing, ductwork pressure testing, etc.), the Contractor shall prepare and submit to the Owner, A/E team and CxA a testing plan that details how the progressive testing will be performed, documented and presented for approval prior to the start of any testing activities.
- D. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process
  - 1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.
  - 2. Installation testing reports such as ductwork pressure testing, piping hydrostatic testing, piping chemical treatment and flushing, bolt flange torqueing, and any documentation associated with local code authority inspections or authorizations.
  - 3. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.
  - 4. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All materials and installation shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process
- C. Contractor is required to follow all applicable industry and site specific safety practices, lockout / tagout requirements, specialized PPE requirements, and provide qualified, trained personnel to execute Commissioning Process requirements.

### 2.2 TEST EQUIPMENT

- A. Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- B. 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.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION PHASE

- A. In each purchase order or subcontract that is written for changes in scope, include the appropriate requirements for submittal data, Commissioning documentation, testing assistance, Operating and Maintenance (O&M) data, and training, as a minimum.
- B. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Owner, CxA or Contractor to facilitate the Commissioning process.

- C. Provide manufacturer's data sheets and shop drawing submittals of equipment.
- D. Provide additional requested documentation to the Owner and/or CxA, prior to O&M manual submittals, for development of System Verification Checklists and Functional Performance Testing procedures.
  - 1. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information.
  - 2. In addition, the installation, Start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Contractor and/or CxA.
  - 3. This information and data request may be made prior to normal submittals.
- E. With input from the BAS vendor and A/E, clarify the operation and control of commissioned equipment in areas where the Specifications, BAS control drawings, or equipment documentation are not sufficient for writing detailed test procedures.
- F. During the installation, Start-up and initial checkout process, execute and document related portions of the System Verification Checklists for all commissioned equipment according to the procedures indicated in the Commissioning Plan.
- G. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
- H. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the System Verification Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that CxA, Owner and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.
- I. Incorporate manufacturer's Start-up procedures with System Verification Checklists (SVC).
- J. Air and water test, adjust and balance shall be completed with discrepancies and problems remedied before Functional Performance Tests of the respective air or water related systems are executed.
- K. Provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.
- L. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and A/E and retest the system and equipment.
- M. During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests).
- N. Provide training of the Owner's operating personnel as specified.
- O. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

### 3.2 WARRANTY PHASE

- A. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.

## HVAC SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.
  - B. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any deferred or seasonal testing.
- 3.3 INSTALLATION
- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
  - B. All installation shall be in accordance with the Project Documents.
- 3.4 TRAINING
- A. Refer to the individual section of this Specification for specific training requirements on each system.
  - B. Refer to the General Commissioning Requirements and Division 01 for overall training requirements related to the Commissioning process and this project.

END OF SECTION

SECTION 23 09 33

BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 – GENERAL

1.1 SCOPE

- A. The existing campus is controlled by an Automated Logic Control system installed by ALC Houston. All new equipment and modifications to existing systems shall be fully integrated into the existing control system including new graphics for all new equipment and is a part of this scope. Upon completion of this project the resulting control system shall have all new controllers for the systems being replaced or added including sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system. In addition, the scope includes upgrading existing BMCS on existing equipment, refer to Article 3.1 for additional information.
- B. Temperature Control System components:
  - 1. Electronic instruments as specified
  - 2. Electric instruments as specified
  - 3. Microcomputer instruments as specified
- C. All control devices of the same type product shall be of a single manufacturer.
- D. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
  - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
  - 1. All components and elements.
  - 2. Start-up and point verification.
  - 3. The testing and acceptance procedure.
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. **The cost of the work specified in this section is included in an allowance.**
  - 1. **Selection of subcontractor will be determined at a future date.**

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).
  - 1. Temperature control equipment & Field devices.
  - 2. Wiring & Flow diagrams.
  - 3. Sequence of operation.
  - 4. Complete, detailed, control and interlock-wiring diagram.
  - 5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish



through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.

6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply", "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

#### 1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

#### 1.5 METERING AND VERIFICATION REQUIREMENTS

- A. This project is a CHPS applicant. Granular data, derived from the BAS and inherent to this specification, is to be handled in such a way as to support this certification. Granular data is defined as temperatures, set points, run times and utility monitoring. This data is to be monitored on a fifteen-minute interval basis and stored in the BAS database. The BAS must have the inherent capability to trend and display all information as described below.
- B. Monitoring software must include outside environmental condition data which affect building performance. Heating degree days and cooling degree days must be logged and formatted in such a way that the data may be used for comparative analysis of multiple facilities, this facility and any CyFair ISD facility on a historical basis over time. This data must be imported from a reliable, certified, third party source. On site instrumentation is not acceptable.
- C. Metering and Verification requirements must be inherent to the BAS. It cannot be a "bolt on" product. It shall be of no extra cost to the project. It shall be easily accessible from the graphical interface on the main screens. It shall also be accessible from the BAS navigation tree. Data must be retrieved and stored in the BAS module until it is archived on the BAS server. Data acquisition and storage must continue even if communication to the facility is lost. Data for utility consumption and environmental indexing must be stored on the server for a minimum of two years.
- D. All data described in this section shall be easily extractable, without external software or programming.

#### 1.6 WARRANTY

- A. Provide with a manufacturer's parts and labor warranty for a period of two years from substantial completion. Warranty shall include unlimited telephone technical support during the warranty period.
- B. Provide DDC controllers with a manufacturer's parts and labor warranty for a period of 5 years from substantial completion.

### PART 2 – PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Automated Logic Branch Office – WebCTRL

#### 2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.
- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the

network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.

- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

## 2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.
- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure or malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.
- C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.
- D. Network shall support a minimum communications speed of 115.2 Kbps.
- E. The network shall support a minimum of 100 DDC controllers and PC workstations.
- F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.
- G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

## 2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.
- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
  - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
  - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
  - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
  - 4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.
- E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system and

databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring

- G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
  2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
  3. **All BMCS control modules shall have Hand Off Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.**
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
  2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
  3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

## 2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.
1. Point database
  2. Operator interface
  3. Network communications
  4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.
- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

## 2.6 FACILITY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with standard and custom report generation functions that include:
  - 1. Alarm summaries
  - 2. Motor status summaries
  - 3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
  - 4. Program listings
- B. All reports shall be either displayed or printed by:
  - 1. Operator request.
  - 2. Time of day.
  - 3. Event conditions (such as in response to an alarm, interlock, etc.).
- C. All reports shall be time and date stamped.
- D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.
- E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.
- F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.
- G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.
- H. Any invalid operator entry shall result in an error message.
- I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.
- J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

## 2.7 ENERGY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.
  - 1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
  - 2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
  - 3. A built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.

1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
  2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
  3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
  4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
  5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.
- C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:
1. Enthalpy optimization.
  2. Supply air reset.
  3. Hot water reset.
  4. Chilled water reset.
  5. Volumetric control.
  6. Dead band control. Install dual set points as requested by user.
  7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.
  8. Time lapse graphics
  9. Global point commands

## 2.8 WEB SERVER ACCESSIBILITY

- A. Industry leading encryption technology to provide accessibility through a web browser.
- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
1. Alarm Display
  2. Point Commanding
  3. Graphic Display
  4. Scheduling
  5. Running Reports
  6. Point Details

## 2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
1. Alphanumeric pagers
  2. Numeric pagers
  3. Email
  4. Phones via voice or short message service (SMS) Text Messaging

## 2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
1. Modules may be mounted remote from the DDCP.
  2. Shall communicate with the DDCP over a pair of twisted cables.
  3. Operator shall have the ability to manually override automatic or centrally executed

commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

4. All BMCS control modules shall have Hand Off Auto (HOA) switches on all outputs for HVAC and electrical, including digital outputs.

## 2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
  1. Variable Air Volume (VAV) boxes
  2. Constant Air Volume (CAV) boxes
  3. Dual Duct Terminal Boxes
  4. Unit Conditioners
  5. Variable Refrigerant Volume DX System
  6. 100% Outside Air Split System
  7. Room Pressurization
  8. Fan Coil Units
- B. Include the following items:
  1. All input and outputs necessary to perform the specified control sequences.
    - a. Analog outputs shall be industry standard signals such as 24V floating control.
  2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
  3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
  4. Return to full normal operation without user intervention after a power outage of unlimited duration.
  5. Operation programs shall be field selectable for specific applications.
  6. Specific control strategy requirements, allowing for additional system flexibility.
  7. Controllers that require factory changes of all applications are not acceptable.

## 2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
  1. Spring return to full travel position.
  2. Built in auxiliary switches (motor end switches)
    - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
  3. Minimum torque 60-in-lb
- B. Modulating damper operators:
  1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure
  2. Select the operator with available torque to exceed the maximum required operating torque by not less than 50%
  3. Minimum torque 100 in-lb

## 2.13 ETHERNET CARD

- A. Ethernet Card:
  1. Local area network connection interface card.

## 2.14 CONTROL CABINETS

- A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
  1. Powder coat painted on all sides
  2. Cabinet with continuously piano type hinged door
  3. Locking latch
  4. All locks shall use a common key
  5. Devices on the panel face must be identified with engraved nameplates.
  6. Panels or termination panels must be identified with engraved nameplates.
  7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

## 2.15 EMERGENCY SHUTDOWN STATION

- A. Lockdown Switch:
  - 1. Mushroom Red Button within a clear plastic cover
  - 2. Latches when depressed
  - 3. Twist reset
  - 4. Sign "HVAC SHUT-DOWN"
  - 5. Manufactured by STI Model # SS2031HV-EN

## 2.16 REFRIGERANT MONITOR

- A. Infrared Halogen Gas monitoring system for low level continuous monitoring of numerous CFC, HFC and HCFC halogen gases used in most refrigeration and air conditioning systems.
- B. Two years parts and labor warranty.
- C. Analyzer:
  - 1. Microprocessor based
  - 2. Infrared (IR) sensor technology
  - 3. Sensing down to 1 (PPM)
  - 4. Monitor multiple compounds
  - 5. Automatic calibration
  - 6. Synchronous 2 wave length infrared filterometer
  - 7. Insensitive to vibration and temperature variations.
  - 8. Response Time: Min.5 sec / Max. 90 sec.
  - 9. Sampling Mode in Auto and Manual operation
- D. Multi-Point Sampling System:
  - 1. Minimum of six sample points
  - 2. Adjustable sampling time, with optional skip and hold features for each point.
  - 3. Sample lines up to 500' in length
  - 4. Three stage alarms for each point
  - 5. Flow loss and malfunction indicators
  - 6. Individual relay contacts for each set of channel alarms.
  - 7. Infrared detection
- E. Alarming and Display:
  - 1. Digital display in PPM/PERCENTAGE
  - 2. Provide a 0-10V and 4-20mA output for direct input into the Building Management System or Direct Digital Control System.
  - 3. Adjustable three level alarm for each point shall and be supplied with common alarm output contacts.
  - 4. Provide local digital indication of PPM level for each sample point.
  - 5. Loss of any sample flow
  - 6. Identify alarm point by flashing display and actual PPM.
  - 7. Automatic zero mechanism and malfunction indicators.
  - 8. Silence audible alarm switch with re-activation after adjustable time delay.
- F. Power requirement:
  - 1. 120 VAC
- G. Audible sound pressure level of at least 15Dba above the operating ambient noise level within machine room and providing a distinctive strobe type visual alarm both inside and out side machine room at each entrance. Ceiling mounted rotating beacon in center of machine room. Strobes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. A clearly identified switch of the break-glass type shall be provided immediately adjacent to and outside of each refrigeration machinery room exit.
- H. Acceptable manufacturers:
  - 1. General Analysis Corporation
  - 2. Yokogawa Corporation

3. MSA
4. Sherlock
5. Vulcain

## 2.17 AUTOMATIC CONTROL VALVES

- A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.
- B. Construction:
  1. 2" and smaller:
    - a. Screwed.
    - b. Bodies and internal parts: Bronze, stainless steel or other approved corrosion-resistant metal.
  2. 2-1/2" and larger:
    - a. Flanged.
    - b. Bodies: Cast iron or cast steel.
    - c. Seats and parts exposed to fluid: Bronze, stainless steel or other approved corrosion-resistant metal.
  3. Characterized port ball valves are acceptable for VAV terminal units only.
- C. Modulating straight through water valves: Equal percentage contoured throttling plugs.
- D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.
- E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
  1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
  2. Maximum pressure drop: 5.5 psi.
  3. Relief and bypass valves: Sized according to pressure available.
  4. 2-position valves: Line size.
  5. Manual by-pass operator.
- F. Electronic Actuator:
  1. Direct coupled installation
  2. Visual and electronic stroke indicator
  3. Die-cast aluminum housing
  4. Manual override
  5. Self-lubricating bearing and gear train
  6. Automatic calibration
  7. Automatic duty cycle protection
  8. Overload and stall protection
  9. Non-spring return
  10. Floating /0-10 VAC / 4-20mA operation
  11. UL approved
  12. Provide smooth modulating action and tight close off against the system pressure.
  13. Torque to exceed the maximum required operating torque by not less than 50%.
  14. Actuator input signal shall be compatible with output DDC controller.
  15. Provide weatherproof enclosure (exterior use).
  16. Damper actuators not acceptable for valves.
- G. Cooling Tower By-Pass and Chiller / Cooling Tower Isolation Valves & Actuators:
  1. Valve Bray (Series 3L or NYL)
    - a. Line Size Valve
    - b. Under-cut disk for smooth operation
    - c. Full Lug Valve
    - d. Cast Iron Body
    - e. EPDM - Seat
    - f. 416 Stainless Steel Stem
    - g. Nylon Coated Ductile Iron Disc
    - h. Disc-to-stem connection shall utilize a double "D" or key design requiring no screws or pins to connect stem to disc.
  2. Electronic Actuator: Bray (Series 70)
    - a. Fully configurable without need for software or handheld settings device



- b. Direct Mount
- c. Solid state speed control
- d. Visual and electronic stroke indicator.
- e. Anti-Condensation Heater (exterior actuators)
- f. Die-cast aluminum housing.
- g. Manual override by means of hand wheel
- h. Self-lubricating bearing and gear train.
- i. All steel self-locking output gearing to be provided
- j. Continuous Duty Rated Motor
- k. Overload and stall protection.
- l. Floating /0-10 VAC / 4-20mA operation.
- m. Mechanical Travel stops
- n. UL approved.
- o. Smooth modulating action.
- p. Tight close off against the system pressure.
- q. Sized to exceed 150% of the maximum required operating torque of the valve while under the maximum rated shut-off pressure
- r. Actuator input signal shall be compatible with output DDC controller.
- s. Provide weatherproof enclosure
- t. Damper actuators not acceptable for valves.

- H. Variable Primary Flow By-Pass Control Valve:
  - 1. Modulating straight through control valve with equal percentage contoured throttling plug and electronic operator.
  - 2. Maximum pressure drop: 10 psi
  - 3. Sized for minimum flow of one chiller
  - 4. Torque to exceed the maximum required operating torque by not less than 150%.

## 2.18 DIFFERENTIAL PRESSURE SWITCHES

- A. Wet/wet differential pressure switch
  - 1. Integral Mounting Frame
  - 2. Watertight, dust-tight, and corrosion resistant enclosure.
  - 3. Wetted materials of brass and fluoroelastomer.
  - 4. Externally adjustable set point
- B. Approved manufacturer:
  - 1. Square D #9012GGW4
  - 2. Dwyer #DXW-11-153-1
  - 3. Carrier #HK06ZC033

## 2.19 TEMPERATURE LOW LIMIT SWITCH

- A. Responsive to the coldest 1' section of its length.
  - 1. Double pole single throw switch
  - 2. 20' capillary
  - 3. Line voltage with bellows actuated switch
  - 4. Auto reset for outdoor installation
  - 5. Manual reset for indoor installation

## 2.20 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
  - 1. Thermistor with resistance of 10,000 ohms at 77°F.
  - 2. Accuracy shall be +/-1/2°F.
  - 3. Range of 45° to 95° F operating range.
  - 4. Provide manufacturers calibration certificate.
  - 5. Flush Mounted
    - a. Stainless steel flush mount sensor, submit sample for review.
  - 6. Location and height to be approved by Architect/Engineer prior to installation.
- B. Space / Duct Humidity Sensor

1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
  2. Capacitance element shall be field replaceable and not require calibration.
  3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
  4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
  5. Provide locking metal covers suitable for institutional use. Submit sample for review.
  6. Provide manufacturers calibration certificate.
  7. Provide metal guards in the following locations:
    - a. Corridors
    - b. Cafeteria
    - c. Kitchen.
    - d. Gymnasium.
    - e. Dressing Rooms.
    - f. Industrial Labs.
- C. Duct Temperature Sensors
1. Range of 20° to 120°F.
  2. Single point sensing of temperature.
  3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
  4. Averaging elements of sufficient length to provide accurate, representative indication and control.
  5. Averaging elements of sufficient length to prevent variances in temperature or stratification.
- D. Liquid Immersion Temperature Sensors
1. Platinum type resistance temperature detector (RTD).
  2. Match sensor range to medium being monitored.
    - a. Hot water range 30° to 250°F.
    - b. Chilled Water 20° to 70°F.
  3. Furnish stainless steel wells for installation by Mechanical Contractor.
  4. Locate all sensors in field with Owner/Engineer present.
  5. System accuracy for liquid temperature sensing shall be +/-1/2°.
  6. Sensors must be removable from wells.
- E. Outside Air Temperature and Humidity Sensor
1. Temperature
    - a. Range of -40° to 140°F.
    - b. Accuracy shall be +/-0.9°F
    - c. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.
  2. Humidity
    - a. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
    - b. Accuracy shall be +/-2%
    - c. Range from 20 to 95% RH.
    - d. Relative humidity sensors shall have the sensing element of inorganic resistance media.
  3. Weatherproof sun shield consisting of multiple white plastic plates to reduce the thermal effects of the sun and increasing air flow between the plates.
  4. Sensor shall be mounted a minimum of 6" from all building structures.
  5. Minimum of 8' long leads.
  6. Provide manufacturers calibration certificate.
  7. Provide with a 5-year warranty
  8. Manufactured by ACI Model # A/-RH2-AN-O-SUN---NIST
- F. Freezer / Cooler Sensors
1. Thermistor with resistance of 10,000 ohms at 77°F.
  2. Accuracy shall be +/-1/2°F.
  3. Range of -40°F to 210°F.
  4. Provide manufacturers calibration certificate.
  2. Die cast aluminum construction
  3. Liquid tight wire connector to isolate sensor chamber from exterior temperature influence.

4. 1/2" NPT threaded hub
5. Mamac Systems Model #TE-205-F-12
6. Reuse existing wiring penetrations through cooler or freezer where possible. If existing penetrations through cooler or freezers cannot be reused, seal existing holes with silicon such that opening is airtight.
7. All new penetrations into the cooler or freezer body shall be sealed airtight using silicon. This shall include screw holes and wiring penetrations.

## 2.21 CURRENT SENSITIVE RELAYS

- A. Ensure compatibility with VFD applications for variable speed motor status.
  1. Provide with adjustable set point.
  2. Relays must be mounted and not hung by power wires thru CT.
  3. Provide split-core type current sensors.
  4. Loop powered.
  5. LED Status.
  6. Acceptable Manufacturer: Veris Industries / Hawkeye
  7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.
  8. To be used on towers, vertical turbine pumps, exhaust fans and direct drive equipment only.

## 2.22 DIFFERENTIAL PRESSURE TRANSDUCER

- A. Transducers to convert differential pressures to 4-20 MA analog outputs.
  1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
  2. Factory calibrated and have zero and span trimmers for field calibration.
  3. Range shall be selected to match the medium being monitored.
  4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
  5. LCD Display
  6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

## 2.23 FLOW DIFFERENTIAL PRESSURE SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system differential pressure.
  1. Select the pressure range based on the sensed differential pressure.
  2. The unit shall be protected against overpressure to the full static pressure rating.
  3. Accuracy: +/- 2% of full scale.
- B. Switch assembly.
  1. Reed switch.
  2. NEMA-4 enclosure.
  3. Threaded boss conduit entrance.
  4. SPST action.
  5. Voltage and rating as required for the control circuit.
- C. Wetted parts shall be made of type 303 stainless steel.
- D. Install an isolation valve in each sensing pipe leg to permit servicing without shutting the system down.

## 2.24 ELECTRIC REMOTE BULB THERMOSTAT

- A. Two position remote bulb thermostat:
  1. Bimetal controlled.
  2. Sealed mercury switches.
  3. Provide specified control action.
  4. Adjustment can be made by removing unit cover.
  5. Element with capillary length as required for the location.

## 2.25 ELECTRIC SPACE THERMOSTAT

- A. Two position space thermostat.
  - 1. Single Pole switch actuated by bi-metal sensing element.
  - 2. Range shall be 60°F to 90°F.
  - 3. Removable external knob adjustment means.
- 2.26 HIGH STATIC PRESSURE SWITCH
  - A. With manual reset switch
    - 1. Approved manufacturer: Cleveland AFS-460.
- 2.27 INSERTION FLOW SENSORS
  - A. Electromagnetic Flow Meter
    - 1. Retractable hot tap flow sensor
    - 2. Accuracy: +/- 1% of full scale
    - 3. Electromagnetic
    - 4. Custom thread-o-let 400 psi / 250 degree F rated.
    - 5. Line size from 1-1/4 to 72 inch
    - 6. Metering range from 0.3 to 15 f/sec.
    - 7. Remote NEMA 4 wall mounted LCD display
    - 8. Field Pro Software & Communicator
    - 9. Warranty two years
    - 10. Approved Manufacturer Onicon Flow Meter F3500 or FT3500
- 2.28 CONTROL DAMPERS
  - A. Opposed blade dampers:
    - 1. Frames of 13-gauge galvanized sheet metal.
    - 2. Provisions for duct mounting.
    - 3. Damper blades not exceeding 8" in width.
    - 4. Blades of two sheets of 16-gauge galvanized sheet metal.
    - 5. Blades suitable for high velocity performance.
    - 6. Bearings of nylon or oil-impregnated, sintered bronze.
    - 7. Shafts of 1/2" zinc plated steel
    - 8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
    - 9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
    - 10. Submit leakage and flow characteristics data with shop drawings.
    - 11. Linkage shall be concealed out of the air stream within damper frame.
    - 12. Acceptable Model is Ruskin Model CD60.
- 2.29 PHOTO CELL CONTROL
  - A. Light Sensitive Resistor:
    - 1. 4-20 output or switch
    - 2. On = 3.0 / fc. Off 10.0 / fc
    - 3. UL Approved
- 2.30 DRAIN PAN FLOAT SWITCH
  - A. Rated at 10 Amps:
    - 1. Shuts off equipment if water level becomes too high.
    - 2. DPDT Contacts.
- 2.31 BY-PASS AUTOMATIC SHUT-OFF TIMERS
  - A. Rated at 10 Amps, 125 VAC:
    - 1. Shuts off equipment with timed switch
    - 2. White decorated timer
    - 3. Without hold feature
    - 4. Time Cycle 60 minutes
- 2.32 TEMPERATURE/CO<sub>2</sub> SENSOR

- A. Sensor combo in one housing, Temperature and CO2.
- B. Provide combo temperature/CO2 sensor in the following locations:
  - a. Each Classroom
  - b. Library
  - c. Cafeteria
  - d. Gymnasium
- C. 0-2,000 ppm CO2
- D. CO2 sensor shall have a self-calibration feature.
- E. Temperature accuracy shall be  $\pm 1/2^{\circ}\text{F}$ .
- F. Temperature range shall be  $32^{\circ}$  to  $120^{\circ}\text{F}$
- G. Location and height to be approved by Architect/Engineer prior to installation.
- H. Internal RJ11 Communication jack at sensor for communications.
- I. Provide metal guards in the following locations:
  - a. Corridors
  - b. Cafeteria
  - c. Kitchen.
  - d. Gymnasium.
  - e. Dressing Rooms.
  - f. Industrial Labs.
- J. Color to be approved by Architect / Owner, submit sample for review.

#### 2.33 AIR FLOW SENSING SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system positive, negative, or differential pressure.
  - 1. Select the pressure range based on the sensed differential pressure.
  - 2. The unit shall be protected against overpressure to the full static pressure rating.
  - 3. Accuracy:  $\pm 2\%$  of full scale
- B. Switch assembly:
  - 1. Reed switch
  - 2. Field adjustable setpoint
  - 3. Threaded boss conduit entrance
  - 4. SPST Action
  - 5. Voltage and rating as required for the control circuit

#### 2.34 HVAC SHUTDOWN STATION

- A. Shutdown Switch:
  - 1. Yellow Mushroom Button within a clear plastic cover
  - 2. Latches when depressed
  - 3. Twist reset
  - 4. Sign "HVAC SHUTDOWN"
  - 5. Manufactured by STI Model # SS2231HV-EN

#### 2.35 CARBON MONOXIDE MONITORING SYSTEM

- A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room. The Carbon Monoxide Detector and the boilers and gas water heaters shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler's or gas water heater's burner upon loss of power to the detector.

- B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module or Greystone Model CMD5B series.
  - 1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
  - 2. NEMA 1 Enclosure
  - 3. Complies with Texas State Boiler Code 65.603-2015
  - 4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
  - 5. Provide expansion board for additional equipment interlocks.

### PART 3 – EXECUTION

#### 3.1 UPGRADE TO EXISTING BMCS SYSTEM

- A. Each scope listed below shall be broken out from the addition and renovation portions of the project in proposal.
- B. Dual Duct Terminal Unit Upgrade
  - 1. Provide costs associated with providing all necessary hardware, software, project management, engineering, programming, graphics, installation, point to point, startup/checkout, training and warranty to provide a complete turnkey replacement of existing UNI-cards per area as follows:
    - First Floor
      - a. Area A1 – (4) DD Box – Full Upgrade
      - b. Area C1 – (26) DD Box – Full Upgrade
      - c. Area F1 – (5) DD Box – Full Upgrade
      - d. Area U1 – (4) DD Box – Full Upgrade
    - Second Floor
      - a. Area A2 – (5) DD Box – Full Upgrade
      - b. Area C2 – (11) DD Box – Full Upgrade
- C. Central Plant
  - 1. Provide costs associated with providing all necessary hardware, software, project management, engineering, programming, graphics, installation, point to point, startup/checkout, training and warranty to provide a complete turnkey controls upgrade/replacement and upgrade that includes reusing existing sequences and providing all new controls modules and end devices for:
    - a. (4) Chillers
    - b. (6) CHWPs
    - c. (3) Cooling Towers
    - d. (3) CW Pumps
    - e. (7) Boilers
    - f. (2) HW Pumps
    - g. Interior Lighting
    - h. Exterior Lighting
    - i. Building Electric Meter Monitoring

#### 3.2 INSTALLATION

- A. The control system shall be installed and final adjustments made by full-time employees of the factory-approved BMCS Building Management Control Subcontractor.
- B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.
- C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore, labor allowances should be made for such changes and adjustments if requested.

#### 3.3 INTERLOCK AND SAFETY CIRCUITS

- A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
  - 1. The damper and actuators are specified in this section.

2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
3. Provide motorized outside air dampers for the following:
  - a. Supply fans
  - b. AHUs
  - c. Exhaust fans (except kitchen exhaust)
  - d. Outside air intakes
  - e. Relief air hoods
- B. Close the chilled and hot water valves to the coil when the related unit is de-energized.
- C. Interlock each chiller to start its dedicated chilled and condenser water pumps. Interlock pressure differential switch and pump auxiliary contacts in series to chiller safety terminal strip.
  1. On shutdown provide a circuit to permit the chilled water pumps and condenser water pumps to run while the chillers pump down as required by the manufacturer.
  2. As per manufacturer's recommendations.
- D. Primary chilled water control:
  1. Operating and safety controls are furnished as an integral part of the water-chilling unit and not specified in this section.
  2. Provide pressure differential switch located in the chilled water and condenser water piping to each water-cooled liquid chiller.
    - a) Interlock to prevent operation in the absence of flow.
    - b) This may not be the prime controller to start/stop the chiller.
    - c) Interlock thru pump auxiliary contacts.
  3. Provide a high limit temperature sensor in each primary chilled water pump loop.
- E. Exhaust/Supply Fans:
  1. Interlock the related exhaust and supply fans and the related outside air damper.
  2. Interlock the exhaust fans with the related air-handling unit through software. The new BMCS shall integrate all existing fan interlocks.
  3. Interlock related exhaust fan for dishwasher with time delay off relay.
  4. Interlock related exhaust fan for kiln with time delay off relay
  5. Interlock kitchen hood related supply and exhaust fans.
  6. Provide additional interlocks as indicated on fan schedule and on drawings.
  7. Interlock electrical and mechanical room exhaust fans with thermostat.
  8. Interlock refrigerant monitor with mechanical room purge system.
  9. Interlock science room related supply and exhaust fans.
  10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.
- F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor and oil level switch on each cooling tower fan.
- G. Freeze Protection:
  1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
    - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
    - b. Boilers - Enable during a freeze condition.
    - c. Air Cooled Chillers – enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
    - d. Protect heating water coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper,

disable the DX cooling coil. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.

2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.
- H. Drain Pan Float Protection:
  1. Interlock to shut down unit and close valves.
  2. Cooling Coils mounted above ceiling and in roof mounted units.
  3. Provide for each cooling coil location.
  4. Signal BMCS alarm point
- I. HVAC Shutdown Station:
  1. Provide an emergency mushroom style push / pull station shutdown switch in a Administration Area or as directed by Owner / Architect.
  2. Signal the building automation system to de-energize the HVAC equipment.
  3. This is to stop exhaust fans and outside air units immediately.
  4. Other air handling units, chillers and equipment shall be shut down in an orderly manner so as to not damage the equipment.
  5. Once stopped, the system may only be restarted by relatching the emergency push button switch.
- J. Science Room Utility Controllers:
  1. Interlock the utility controllers with related air-handling unit through software.
- K. Domestic Water System:
  1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
  2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.
- L. Condensing Hot Water Boilers:
  1. Interlock each boiler to start its dedicated pump.
  2. Install communication cable between each boiler and master controller specified by boiler manufacturer.

### 3.4 GRAPHICS

- A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.
  1. Modification of existing control systems shall be included.
  2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
  3. Provide final sequence of operation in written format.
- B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.
- C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.
- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by District. Any changes during the warranty period shall be included.
- F. Provide a summary page for each type of equipment. Summary pages shall be provided for, but not limited to, DDB, EF, AHU, CH, CT, Pumps, and FCU. Summary pages shall include the ability to modify the global set points for each equipment type.
- G. Provide an alarm management and reporting graphical page. This page shall allow user to create,



acknowledge and adjust alarms. All alarms shall have the ability to be selectable for remote notifications and control which personnel is notified.

- H. System shall include a graphical page that contains building and system related documents stored for ease of remote access.
- I. System shall include a real time dynamic dashboard to provide real time analysis of conditions and equipment performance.
- II.
- J. System shall include a real time dynamic Central Plant Energy / Status dashboard. Dashboard shall display the following at a minimum:
  - 1. Actual Plant operating Tons
  - 2. Total Plant Capacity Available
  - 3. Percent Usage of Available Capacity
  - 4. Current Plant operation KW/Ton
  - 5. Current Chiller KW/Ton
  - 6. Bar Chart indicating energy consumption by plant component (Chillers, CW Pumps, CHW Pumps and Exhaust Fans)
  - 7. Tables for Chillers, Chilled Water Pumps, Condenser Water Pumps, and Cooling Tower Fan. The chart shall indicate S/S, Status, KW Consumption, Alarm Status Running AMPS on Chillers.
  - 7. Trending Graph (Total Chiller KW/Ton and Total Plant KW/Ton)

### 3.5 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.
- C. A red-white-red 2"x8" laminated plastic engraved identifying nameplate shall be secured to each audible/visual alarm and emergency shutdown device. Provide identification and location of each A/V device laminated in plastic and hung at refrigerant monitor with identification, location of devices and proper operation of system in a graphic floor plan with written sequence of operation. Identifying nameplates shall have ½ inch high, engraved letters. A red-white-red 12"x12" laminated plastic engraved identifying name plate shall be secured to outside of each door to machine room with "A REFRIGERANT LEAK HAS BEEN DETECTED IN THIS BUILDING WHEN AUDIBLE/VISUAL ALARM IS ENABLED. DO NOT ENTER. CONTACT MAINTENANCE DEPARTMENT."

### 3.6 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System. In addition, furnish, and install all wire, conduit, raceways and cable systems required with the VRF system in the Administration area.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
  - 1. Wiring of interlock system.
  - 2. Wiring of control instruments.
  - 3. Wiring of control panels.
  - 4. Wiring of related power supplies, i.e. transformers.
  - 5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.
- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.

- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other exposed ceiling spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridle rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
- H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.
- I. All wiring associated with building management and control system cover shall be as follows:
  - 1. Sensor jacket color, Green
  - 2. LAN communications, Yellow
  - 3. All THHN wiring shall comply with Division 26 insulation color identification

### 3.7 EXHAUST AND SUPPLY FANS

- A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.
- C. Dampers and actuators shall be provided by this contractor and shall not be furnished with the exhaust fan.
- D. Dampers and actuators shall be provided by this contractor and shall not be furnished with the exhaust fan.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Fan Status	DI	Current Sensitive Relay (EF) Air Flow Sensing Switch (SF)
Outside Air Damper	DO	Electronic Operator

### 3.8 MISCELLANEOUS

- A. MDF/IDF Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions. BMCS shall alarm when temperature is out of setpoint range.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

- B. Photocell: Provide a photo sensor mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
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Photocell	AI	Contact
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C. Interior Lighting Control:

Building Management Control System Scope

The lighting control system, as indicated on the electrical drawings lighting control details, will be provided with lighting control system BMCS interface devices via DLM room controllers, refer to Electrical Drawings and Details. The BMCS system shall send a occupied and unoccupied signal to the lighting control system BMCS interface devices based on a BMCS schedule.

The BMCS provider shall provide an additional 8 hours of technician support to ensure the lighting control system is commissioned and operating as described.

Lighting Control System Scope

When the Lighting Control system BMCS interface devices in an area receives an occupied signal from BMCS, the lights in that area shall remain in their current state (typically off) but allow any local switch in that area to control the lighting in that space.

When the Lighting Control system receives an unoccupied signal from BMCS, the lighting control system shall flash the lights, and after a delay, the lights in that area shall be swept off by the lighting control system. In this unoccupied mode, the lighting control system shall allow any local light switch in that area to allow the lights to be controlled locally for 2-hours upon being switched on by the local switch. After the 2-hours, the lighting control system enable signal shall expire, and the lights shall again flash a warning, and if the local switch is not again activated, the lights shall be turned off by the lighting control system.

POINT DESCRIPTION	TYPE	DEVICE
Interior Lighting Control		DLM Room Controller

D. Exterior Lighting Control

1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
  - a. Provide separate control of each contactor.
2. The exterior lights shall be controlled by the BMCS using both a combination of photosensor, time schedules and astronomical sunrise/sunset. The exterior lights shall automatically come on when the sun sets based on the longitude and latitude coordinates of the facility (adjustable +/- 30 minutes). At 11 p.m. (adjustable) the time schedule shall turn off the exterior lights. At 4:00 a.m. (adjustable) the exterior lights shall automatically turn on based on time schedule. Upon sunrise, which shall be based on longitude / latitude of the facility the exterior lights shall turn off.
3. Between sunrise and sunset, photo-sensor shall only deactivate all exterior lighting when ambient light levels are above set point (adjustable).

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

E. Freezer/Cooler Temperature Monitoring:

1. The existing cooling and freezer are being replaced. Provide new analog temperature sensor located in the freezer compartment and cooler compartment.

POINT DESCRIPTION	TYPE	DEVICE
Freezer Alarm	AI	RTD
Cooler Alarm	AI	RTD

- F. The new athletic storage building shall be controlled locally and shall not be part of the BMCS system.
  - G. Tennis Court Lighting Control: The controls for AUTO shall accept a signal from the Building Management Control System (BMCS) for control of the tennis court lighting. The BMCS signal used for the interior lighting Wattstopper controls building occupied/un-occupied state shall enable/disable a BMCS tennis court lighting scheduled. The tennis court lighting shall turn ON 20-minutes prior to sunset and turn off at a scheduled time as directed by Owner. Either a building Wattstopper un-occupied state or a tennis court scheduled turn OFF shall turn the tennis court lights OFF.
  - H. Terminal Unit relocation – This contractor shall remove and install all new controls to support terminal unit relocation. This work shall include all new wiring and temperature sensor.
  - I. Kitchen Utility Usage: Wire and interface with all meters provided by others as indicated on the drawings and shown below. Provide a separate graphics page for the following items to allow for quick referencing.
    - 1. Kitchen Water Service - Provide digital monitoring and logging, through the BMCS, of the kitchen cold water usage meter and kitchen hot water usage meter. Water meters shall have 4-20 mA signal or pulse for conversion by BMCS into water flow rates. BMCS shall log data for use.
    - 2. Kitchen Gas Service: Provide digital monitoring and logging, through the BMCS, of the of the kitchen gas meter. Gas meters shall have 4-20 mA signal or pulse for conversion by BMCS into water flow rates. BMCS shall log data for use.
    - 3. Kitchen Electrical Service: Provide digital monitoring and logging, through the BMCS, of each Current Transformer Meter added to all kitchen electrical panels and equipment. This shall include the normal power and emergency electrical panels. BMCS shall log data for use.
    - 4. Kitchen Hydronic Chilled and Hot Water Service – Provide meters, digital monitoring and logging, through the BMCS, of the Chilled and Hot water flow rates at the Kitchen Air Handling Unit. Provide separate water meters for each service. BMCS shall log data for use.
    - 5. Provide a separate graphics page for all Kitchen meters. The link to the graphics page shall be categorized under Misc. Equipment. Equipment and trended on a 15-minute interval.
- 3.9 DISHWASHER EXHAUST
- A. Interlock exhaust fan to operate when dishwasher is operating. Provide 5 minute (adjustable) run time for fan after dishwasher stops.
- 3.10 TERMINAL UNIT COORDINATION
- A. Equipment furnished in this section and installed by Section 23 36 16:
    - 1. Automatic temperature control card (DDC).
    - 2. Damper Actuator
  - B. Equipment furnished and installed by Section 23 36 16:
    - 1. Damper.
    - 2. Multi-point flow sensor.
    - 3. Power transformer.
    - 4. Controller enclosure.
- 3.11 DUAL DUCT VARIABLE VOLUME AIR HANDLING UNITS WITH SPLIT DEHUMIDIFICATION UNIT MOUNTED ON TOP (AHU-19, OAHU-13)
- A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position and supply fan. Control shall be as follows:
    - 1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as scheduled. The supply fan shall be started and stopped from the BMCS System.
    - 2. Provide a temperature low limit switch located on the discharge side of the hot water

preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.

3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
Supply Fan Start/Stop	DO	Control Relay
SF Status	DI	Air Flow Sensing Switch
Variable Speed Fan	AO	Motor Controller
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Heating Coil Leaving Air Temp.	AI	Averaging Sensor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

- B. Units consist of a chilled water coil, a hot water coil, a fan, and a variable speed drive. Controls shall be as follows:

1. An electronic averaging duct sensor in the cold duct shall, acting through the DDC System, modulate the chilled water valve to maintain desired setpoint. An electronic averaging duct sensor in the hot deck shall, acting through the DDC system, modulate the hot water valve to maintain desired setpoint. A schedule shall be set up for the hot deck temperature based on outside air temperature. The temperature of the hot deck shall modulate between the following criteria. If the temperature outside is 50°F (adjustable) or below, the hot deck temperature shall be 95°F; if the outside temperature is 75°F or above, the hot deck coil shall be deactivated.
2. The unit shall be started and stopped from the BMCS system.
3. An electronic duct static pressure sensor shall be located in the cold duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93. The sensor shall transmit a signal to the supply fan motor speed controller, and modulate the fan speed to maintain a supply duct static pressure. A high limit static pressure sensor with manual reset, located at the fan discharge, shall de-energize the supply fan when sensing pressure above duct construction capabilities. Fan start-up shall be initiated at minimum air speed.

POINT DESCRIPTION	TYPE	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature (2)	AI	Duct Temperature Sensor, One Each Deck
HW Coil Leaving Air Temp.	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temp.	AI	Averaging Duct Thermistor
Return Air Temp.	AI	Averaging Duct Thermistor

POINT DESCRIPTION	TYPE	DEVICE
HW Valve	AO	Electronic Operator
CHW Valve	AO	Electronic Operator
Duct Static Pressure (2)	AI	Static Pressure Sensor, One Each Deck
Fan Speed	AO	Variable Frequency Drive

### 3.11 DUAL DUCT VARIABLE VOLUME AIR HANDLING UNITS (AHU-17)

- A. Units consist of a chilled water coil, a hot water coil, a fan, and a variable speed drive. Controls shall be as follows:
1. An electronic averaging duct sensor in the cold duct shall, acting through the DDC System, modulate the chilled water valve to maintain desired setpoint. An electronic averaging duct sensor in the hot deck shall, acting through the DDC system, modulate the hot water valve to maintain desired setpoint. A schedule shall be set up for the hot deck temperature based on outside air temperature. The temperature of the hot deck shall modulate between the following criteria. If the temperature outside is 50°F (adjustable) or below, the hot deck temperature shall be 95°F; if the outside temperature is 75°F or above, the hot deck coil shall be deactivated.
  2. The unit shall be started and stopped from the BMCS system.
  3. An electronic duct static pressure sensor shall be located in the cold duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93. The sensor shall transmit a signal to the supply fan motor speed controller, and modulate the fan speed to maintain a supply duct static pressure. A high limit static pressure sensor with manual reset, located at the fan discharge, shall de-energize the supply fan when sensing pressure above duct construction capabilities. Fan start-up shall be initiated at minimum air speed.

POINT DESCRIPTION	TYPE	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature (2)	AI	Duct Temperature Sensor, One Each Deck
HW Coil Leaving Air Temp.	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temp.	AI	Averaging Duct Thermistor
Return Air Temp.	AI	Averaging Duct Thermistor
HW Valve	AO	Electronic Operator
CHW Valve	AO	Electronic Operator
Duct Static Pressure (2)	AI	Static Pressure Sensor, One Each Deck
Fan Speed	AO	Variable Frequency Drive

### 3.12 DOUBLE DUCT VARIABLE VOLUME TERMINAL UNITS

- A. Each unit shall consist of two pressure independent variable volume dampers, one on each duct inlet connection. Controls shall be as follows:
1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper on the cold deck from full open to 40% air flow rate to maintain room setpoint. When heating is required, the temperature sensor shall first modulate the

- variable volume damper on the hot duct and cold deck while maintaining 40% airflow. If more heating is required, the temperature sensor shall modulate the variable volume damper on the hot deck from 40% to full open to maintain room setpoint.
2. The BMCS Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position.
  3. The BMCS Contractor shall furnish the terminal box manufacturer the control flow diagram for correct mounting of flow measurement devices, wiring of actuators, and terminal equipment controllers.

POINT DESCRIPTION	TYPE	DEVICE
Space Temperature	AI	Temperature
Primary Air (2)	AO	Variable Volume Damper Operator
CFM Flow	AI	Control Panel

### 3.13 VARIABLE VOLUME AIR HANDLING UNITS (AHU-20)

- A. Units consist of a chilled water coil, a fan, a variable speed drive, and outside air fan.
- B. The unit shall be started and stopped from the BMCS system.
- C. Discharge air temperature control:
  1. A sensor far enough from the fan discharge to be truly representative of the average temperature shall modulate the valve on the cooling coil to maintain setpoint. Reference drawing schedule for discharge temperature.
- D. Variable air volume control:
  1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
  2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
    - a. Transmit a signal to the supply fan motor speed controller.
    - b. Modulate the fan speed to maintain the desired static pressure.
    - c. Coordinate signal with the fan motor speed controller.
  3. Install a static pressure high limit safety device to de-energize the system.
    - a. Manual reset.
- E. Outside air Fan control:
  1. Each unit will be provided with an outside air supply fan. The supply fan will be activated with the air-handling unit.
  2. A hot water coil or electric heating coil shall be supplied in the outside air ductwork. A duct mounted temperature sensor shall modulate a hot water valve or stages of heat to maintain a leaving air temperature of 55°F (adjustable).
  3. Provide a temperature low limit switch located on the discharge side of the preheating unit to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 37°F. Device shall be manual reset.
  4. During warm-up and cool-down periods (optimum start/stop), the outside air fans shall not be activated. During occupied times, the fans shall be activated.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature	AI	Space Thermistor

POINT DESCRIPTION	TYPES	DEVICE
CHW Valve	AO	Electronic Operator
Outside Air Fan	DO	Control Relay
Outside Air Preheat Valve or Electric Heating Unit	AO DO	Electronic Operator or Relay for each stage
Outside Air Temperature	AI	Duct Thermistor
Duct Static Pressure	AI	Static Pressure Sensor
Variable Speed Fan	AO	Motor Controller
Freeze Status	DI	Temperature Low Limit Switch

### 3.14 CONSTANT VOLUME / VARIABLE VOLUME TERMINAL UNITS

- A. Each unit shall consist of a pressure independent variable volume damper, a constant volume fan, and a hot water heating coil. The fans shall be interlocked with the AHU fan. Constant volume terminal shall start before AHU fan starts. Controls shall be as follows:
1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper from full open to a minimum airflow rate to maintain room setpoint. If heating is required, the temperature sensor shall modulate the hot water control valve to maintain room setpoint with the variable volume damper in the minimum airflow position.
  2. Control valve, and control valve operator are specified in this section.
  3. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, damper position, and hot water valve position.

POINT DESCRIPTION	TYPES	DEVICE
Space Temperature	AI	Space Thermistor
Primary Air	AO	Variable Volume Damper Operator
HW Valve	AO	Electronic Operator
Start/Stop	DO	Control Relay
Discharge Air Temperature	AI	Duct Thermistor

### 3.15 SINGLE ZONE VARIABLE AIR VOLUME AIR HANDLING UNIT WITH SPLIT DEHUMIDIFICATION UNIT MOUNTED ON TOP (AHU-L1, OAHU-L1)

- A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as scheduled. The supply fan shall be started and stopped from the BMCS System.
  2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
  3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto



position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
OA Supply Fan Start/Stop	DO	Control Relay
OA Supply Fan Status	DI	Current Sensitive Relay
OA Fan Speed	AO	Variable Frequency Drive
Discharge Air Temperature	AI	Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

- B. This unit is furnished with a chilled water cooling coil, a hot water reheat coil, and a variable frequency drive. Control shall be as follows:

1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified or to the outside air percentage whichever value is larger. A chilled water coil leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at minimum speed of its specified air quantity and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil and the valve on the hot water coil in sequence to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Fan Speed	AO	Variable Frequency Drive
Space Temperature	AI	Space Thermistor
Space Humidity	AI	Humidity Sensor
CHW Valve	AO (1)	Electronic Operator
Reheat HW Valve	AO (1)	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor

### 3.16 OUTSIDE AIR HANDLING UNIT CONTROL (OAHU-11, OAHU-12)

- A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature of 55°F. The air-handling unit shall be started and stopped from the BMCS System.
  2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
  3. Open OA damper before starting unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature	AI	Duct Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

### 3.17 SINGLE ZONE AIR HANDLING UNITS WITH HUMIDITY CONTROL (AHU-11, AHU-21)

- A. These units consist of a chilled water coil and an electric duct heater in the supply duct. Control shall be as follows:
1. A space temperature sensor shall, acting through the DDC panel, modulate the valves on the chilled water cooling coil and stage the electric duct heater in sequence to maintain the desired space temperatures.
  2. A humidity sensor, located in the return air and/or in the space shall, acting through the DDC panel, modulate the valve on the chilled water coil to maintain 55 degree discharge air when space is above its humidity setpoint and in dehumidification.
    - a. The space temperature sensor shall stage the duct heater to maintain space temperature.
  3. The Space Humidity Sensor shall monitor the space relative humidity at all times. If the space relative humidity rises above the setpoint when the system is de-energized, over-ride the BMCS.
    - a. Energize Air Handling Unit and Central Plant Equipment
    - b. Outside air damper shall remain closed and related exhaust fans de-energized

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Space Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Chilled Water Coil Discharge	AI	Duct Thermistor

POINT DESCRIPTION	TYPES	DEVICE
Outside Air Damper	DO	Electronic Operator
Space Humidity	AI	Humidity Sensor
Electric Heater	DO	Relay
Discharge Air Temperature	AI	Duct Thermistor

### 3.18 TRIPLE DECK MULTIZONE AIR HANDLING UNIT (AHU-12)

- A. These units are blow through triple deck multi-zone air handling units with chilled water cooling for the cold deck hot water heating for the hot deck and a neutral air deck.
- B. The control sequence is as follow:
1. Energize unit as required by the BMCS.
  2. Open the related outside air damper fully when the unit is energized and close when the unit is de-energized.
  3. The cold deck temperature shall be maintained to 55 °F (Adjustable)
  4. A zone temperature sensor shall modulate the zone dampers and stage the electric heat to maintain the space temperature. Fully close the cold deck damper before staging the electric heat.
  5. The cold temperature shall be reset based on the space humidity setpoint.
- C. A combination temperature and humidity sensor is an acceptable alternate to individual sensors at each of these locations.
- D. Reference drawings for equipment information and number of zones.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Space Temperature	AI	Space Thermistor (each zone)
Return Air Temperature	AI	Duct Thermistor
Zone Damper	AO	Electronic Operator
CHW Valve	AO	Electronic Operator
HW Valve	AO	Electronic Operator
Space Humidity	AI	Humidity Sensor (per plans)
Hot Deck Discharge Air Temp	AI	Duct Thermistor (each zone)
Cold Deck Discharge Air Temp.	AI	Duct Thermistor (each zone)
Variable Speed Fan	AO	Motor Controller

### 3.19 AIR COOLED CHILLER REPLACEMENT

- A. The existing air cooled chiller and associated chilled water pump located at the main central plant is being replaced. The existing control sequences shall be remain and be reused.

- B. BMCS contractor shall remove all existing wiring and end devices as required for removal of existing chiller and pump. Provide new wiring conduit and end devices to maintain existing sequence and to provide points as listed below for both chiller and pump.
- C. The new pump is being equipped with a new variable frequency drive. Pump shall be used for soft start and balancing only.
- D. Provide interface to chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPE	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller Status	DI	Safety Alarm Relay
Chiller Alarm	AI	Chiller Control Module
Chiller LWT Temperature Reset	AO	Chiller Control Module
Pump Start/Stop	DO	Control Relay
Pump Status	DI	Current Sensitive Relay
Pump VFD	AO	Variable Frequency Drive
Chiller Supply Water Temperature	AI	Temperature Sensors
Chiller Return Water Temperature	AI	Temperature Sensors

### 3.20 HYDRONIC AND DOMESTIC BOILER CO MONITOR SYSTEM

- A. This contractor shall provide and wire interlocks from equipment to the CO monitor system. Upon alarm through the sensor all the boiler equipment, i.e. boiler and pumps and domestic water heaters, shall be deactivated. CO monitor shall provide a visual and audible alarm. Provide a sign at each entrance to boiler room to indicate information about system.
- B. Upon Alarm of CO monitor, notify users via text message.
- C. CO Monitor control shall be provided at each room that contains gas fired hydronic boilers or domestic water heaters/boilers.

POINT DESCRIPTION	TYPES	DEVICE
CO Monitor	DI	Control Panel
System Start/Stop	DO	Control Relay

### 3.21 REFRIGERANT MONITORING / VENTILATION CENTRAL PLANT APPLICATIONS

- A. Replace the existing refrigerant monitor in the central plant and other locations as required by code as part of the central plant control system upgrade.
- B. Monitor the concentration of refrigerant through an analog input signal through the BMCS. Install (2) sensors at each chiller at opposite ends. Alarm levels of refrigerant concentrations are provided in the Code. Refrigerant levels shall be available at the BMCS.
- B. Install audible and visual alarms in the area served, at locations as required by code. Audible sound pressure level of at least 15DbA above the operating ambient noise level within machine room and provide a distinctive strobe type visual alarm both inside and outside machine room at

each entrance. Ceiling mounted rotating beacon in center of machine room. Strobes shall be provided immediately adjacent to and outside of each refrigeration machinery room exit. Provide visual and audible device installed at locations as per local code.

- C. Provide a clearly identified switches of the break-glass type immediately adjacent to inside and outside of each refrigeration machinery room exit for emergency and activation of the emergency exhaust system and equipment shutdown i.e. chillers and pumps thru safety circuits upon alarm. Mechanical equipment shall be shut down in an orderly manner so as not to damage the equipment. Label switches / buttons per Code.
- D. Provide a separate emergency ventilation buttons located on the inside the building adjacent to each refrigeration machinery room exit for activation of the central plant emergency ventilation system. Upon alarm either through the refrigerant monitor, by manually pushing the central plant emergency exhaust button or pressing the glass break type switch, the emergency exhaust fan shall be modulated to full speed via the VFD. Label switches / buttons per Code.
- E. Activation of emergency exhaust and equipment shutdown shall signal an alarm to the BMCS and signal the audible and visual alarms in the area served.
- F. During normal plant operation the plant exhaust fan shall operate via the VFD at minimum speed as scheduled to provide general plant exhaust.

POINT DESCRIPTION	TYPE	DEVICE
Refrigerant Monitor / Sensors	AI	Control Panel
Emergency Shut	DI	Break Glass Switch
Emergency Ventilation	DI	Emergency Ventilation Button
Fan Start/Stop	DO	Control Relay
Fan Status	DI	Current Switch
Variable Speed Motor	AO	Motor Controller
System Start/Stop	DO	Control Relay

### 3.22 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
  - 1. Field panel checkout:
    - a. Verify enclosure is not mounted on vibrating surface.
    - b. Verify class I and class II wiring is separated within enclosure.
    - c. Check for shorts/grounds/induced voltages/proper voltages.
    - d. Verify proper point terminations in accordance with as-builts.
    - e. Verify that all modules are in proper place and addressed.
    - f. Verify proper power voltage.
    - g. Load database and programming.
    - h. Startup the panel.
    - i. Point and device checkout.
  - 2. Analog input point checkout:
    - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
    - b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.

- c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
  - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
  - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
  - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
3. Digital input point checkout:
- a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
  - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
  - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
  - d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, flow switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
  - e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
4. Digital output point checkout:
- a. Verify that device is correctly wired and terminated as shown in the design documentation package.
  - b. Verify that the correct voltage is utilized in the circuit.
  - c. Verify the point database to be correct (i.e. point name, address, etc.).
  - d. Check and verify that the end device responds appropriately to the digital output(s).
  - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
  - f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
  - g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
5. Analog output point checkout:
- a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
  - b. Insure that the correct output device(s) are installed per the Control System

- Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
- c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
  - d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
  - e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
  - f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
  - g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
  - h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.
6. Terminal equipment controller checkout:
- a. Load program database
  - b. Enable programs
  - c. Verify sequence of operations
7. Programming checkout:
- a. Provide checkout for each system and sequence of operation.
  - b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to meet your specific requirements.
  - c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
  - d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
  - e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
  - f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.
8. Workstation checkout:
- a. Verify the operation of all trunk interface equipment.
  - b. Verify all workstation software, including options, based upon the installation instructions for the PC.
  - c. Perform software backup (site, options, etc.)
  - d. Complete workstation configuration report for owner signoff.

- e. Provide verification that all graphics have been created, as required by project bid documents.

### 3.23 TESTING AND ACCEPTANCE

#### A. General:

1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
  - a. Follow in the order specified.
  - b. Each testing phase shall be satisfactorily completed before entering the next phase.
2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.
3. Submit for approval, a sample of the form on which the test will be reported.
  - a. Identify project.
  - b. Provide a list of all points, arrange in numerical order of point addresses.
    - 1) Show point descriptor and location of each.
    - 2) Indicate DDC panel that processes each point.
    - 3) Use the list as a basis for the specified report form.
  - c. Signatures of participants and observers.
  - d. Results.
  - e. Description of adjustment or corrections of points in error.
  - f. Date.
4. Provide schedule of tests. Estimate dates of significant events.
5. Test, calibrate and adjust each point in the system as specified.
6. Provide documentation of all tests and verifications as specified.
7. Provide trend reports indicating proper control of all points for an extended period of time.

#### B. Phase 1 - Testing, Calibrating, and Adjusting:

1. Operate each analog point in the entire system.
  - a. At a point in the upper quarter of its range.
  - b. At a point in the lower quarter of its range.
  - c. At its operating point.
2. Provide personnel and diagnostic instruments at both the central and remote locations.
3. Provide testing stimulants for alarms.
4. Use digital meters of double the accuracy of the instruments being calibrated.
5. Provide an approved test device for simulating high and low temperatures.
6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
9. Test all power transducers with a Dranetz Power Analyzer.

#### C. Phase 2 - Equipment and Point Verification:

1. Verify calibration or function of each point.
  - a. Verify analog points at operating value.
  - b. Record on specified form.
  - c. Make approved adjustments to out of tolerance points.
    - 1) Identify these points for ready reference.
2. After verification procedure is completed:
  - a. Verify corrected points.
  - b. Record on specified form.
  - c. Points requiring correction.
    - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.

#### D. Phase 3 - Software Verification:

1. Submit agenda and report format for software demonstrations.
2. Demonstrate to the Owner and the Engineer that all software programs and automatic



- control sequences function as specified.
  - 3. Demonstrate compliance with response time specifications.
    - a. Simulate normal heavy load conditions.
    - b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
  - 4. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.
- E. Provide the following reports to Engineer at final completion of all Testing:
- 1. List of all points.
  - 2. List of all points currently in alarm.
  - 3. List of all disabled points.
  - 4. List of all points in over-ride status.
  - 5. List of all points currently locked out.
  - 6. List of user accounts and access levels.
  - 7. List all weekly schedules.
  - 8. List of holiday programming schedules.
  - 9. List of limits and deadbands.
  - 10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
  - 11. List of programs.
  - 12. Provide trend data reports to ensure proper operation and sequence control of BMCS.
- F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

### 3.24 TRAINING

- A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.
- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
- Explanation of drawings, operations and maintenance manuals
  - Walk-through of the job to locate control components
  - Operator workstation and peripherals
  - DDC controller and ASC operation/function
  - Operator control functions including graphic generation and field panel programming
  - Operation of portable operator's terminal
  - Explanation of adjustment, calibration and replacement procedures
  - Student binder with training modules
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

### 3.25 PROJECT MANAGEMENT

- A. Provide a designated project manager who will be responsible for the following:
- 1. Construct and maintain project schedule.
  - 2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
  - 3. Attend project meetings as necessary to avoid conflict and delays.
  - 4. Make necessary field decisions relating to this section.
  - 5. Coordination / Single point contact.
  - 6. Have Internet access for project management.

END OF SECTION

BUILDING MANAGEMENT AND CONTROL SYSTEM

SECTION 23 09 34

COORDINATION OF BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. The Building Management and control System for the facility is being replaced. The items listed below shall be furnished and/or installed by this contractor.

PART 2 - PRODUCTS

- A. Products provided by the Building Management and Control System (BMCS) Contractor.
  - 1. Control Valves
  - 2. Dampers
  - 3. Wells for sensors installed in piping system
  - 4. Flow Meters

PART 3 – EXECUTION

3.1 COORDINATION

- A. Coordinate with the Building Management and Control System (BMCS) Contractor.
  - 1. Provide project-scheduling information to the BMCS Contractor to allow ample time for purchase of equipment and devices.
  - 2. Schedule periodic project meetings to review progress and coordination issues.
  - 3. Submit a written report, to the Architect/Engineer, on a monthly basis stating status of coordination effort.
- B. The BMCS contractor will submit shop drawings to this contractor for review and coordination processing.

3.2 INSTALLATION

- A. This Contractor will be responsible for the following:
  - 1. Installation of control valves for HVAC equipment.
  - 2. Installation of dampers for HVAC equipment.
  - 3. Installation of temperature sensor wells in piping.
  - 4. Installation of pressure taps in piping system.
  - 5. Installation of flow meter taps in piping system.
- B. Install the above material under the direction of the Building Management and Control System (BMCS) Contractor.

END OF SECTION

COORDINATION OF BUILDING MANAGEMENT AND CONTROL SYSTEM



SECTION 23 20 00

HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

- A. Division 23 Mechanical:
1. Earthwork.
  2. Valves, Strainers and Vents.
  3. Vibration Isolation.
  4. Insulation.
  5. Other Piping Sections

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
  2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
  3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
  2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
  3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
  4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
  5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to

HVAC PIPE AND PIPE FITTINGS - GENERAL

ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.

6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:

1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

## 2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
  1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

## 2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

## 2.5 GASKETS

- A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

## 2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

## 2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

# PART 3 – EXECUTION

## 3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming.

Bevel plain ends of ferrous pipe.

- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.

### 3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

### 3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

### 3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.
- B. Provide supports both sides and within 12" of each horizontal elbow for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2" minimum vertical adjustment.
- F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more

than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.

- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Provide hangers within 3' of pipe length from all coil connections.
- I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

### 3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

### 3.6 PIPE SUPPORTS ON ROOF

- A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

### 3.7 PIPE STANDS

- A. Refer to Pipe Stand detail included in drawings for additional information.
- B. All ground mounted pipe stands shall be steel construction and hot dipped galvanized after fabrication.
- C. All pipe stand bases shall be anchored, leveled and grouted to ensure equal weight distribution.

### 3.8 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

### 3.9 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

### 3.10 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:

1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
  2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

### 3.11 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

### 3.12 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

### 3.13 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.
- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
- D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
- E. Dispose of water in approved manner.



- F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.
- G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.
- I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

### 3.14 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

### 3.15 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
  - 1. both sides of penetrations through walls, floors and ceilings.
  - 2. Close to valves or flanges.
  - 3. Intervals on straight pipe runs not to exceed 50 feet
  - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

END OF SECTION

SECTION 23 21 13

HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating water and chilled water piping, valves and appurtenances, including fittings and strainers. Domestic hot water piping is specified in the Domestic Water Piping and Appurtenances section.

1.2 RELATED WORK

- A. Division 23 Mechanical:
  - 1. Pipe and Pipe Fittings - General
  - 2. Valves, Strainers and Vents
  - 3. Vibration Isolation
  - 4. Insulation

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

- A. For pipe 2" and less in diameter, provide pipe conforming to ASTM A 53, Grade A or B, or ASTM A106 schedule 80 seamless, or electric-resistance welded black steel pipe. Furnish 150 lb. screwed malleable iron fittings conforming to ANSI B 16.3 for chilled water. Provide fittings conforming to ANSI B 16.4 for hot water.
- B. For pipe 2-1/2" in diameter and larger, provide pipe meeting the requirements of ASTM A 53, Grade A or B, or ASTM A 106 schedule 80 seamless, or electric-resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 VALVES

- A. Refer to Section 23 05 23.
- B. Refer to Building Management and Control System.

2.3 WATER SPECIALTIES

- A. Pressurized Expansion Tanks shall be precharged steel tank with a replaceable heavy duty Butyl rubber bladder. The tank shall have a 1-1/2" system connection, drain, and a standard tire valve to facilitate on-site charging of the tank. The tank shall be fitted with lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and stamped 125 PSI working pressure.
  - 1. Acceptable manufacturers: Bell & Gossett, Taco, Wessels, John Wood Company, and Wheatley.
- B. Pressure Reducing Valves shall be diaphragm operated with brass body, low inlet pressure check valve and inlet strainer. The strainer shall be easily removed without system shutdown. The valve seat, strainer, and stem must be removable and of non-corrosive material.
  - 1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.
- C. Automatic Air vents shall be float actuated high capacity air vent designed to purge free air from the system and provide shutoff at pressures up to 150 psig at a maximum temperature of 250 degrees F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall purge free air at pressures up to 150 psig during normal system operation. The high capacity air vent shall be constructed of cast iron and fitted with components of stainless steel, brass, and EPDM.
  - 1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.
- D. Air and Dirt Separators shall be a full flow coalescing type combination air eliminator and dirt separator. The separator shall be designed for full flow high volume systems. The inlet and outlet connections shall be the same as adjoining pipe. Vessel shall be fabricated steel, rated for 150 psig

HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet and outlet nozzles. The vessel shall include copper or stainless steel coalescing medium to aid in the separation of air and dirt in the system entrained water. Air elimination efficiency shall be 100% free air, 100% entrained air, and a minimum of 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. Unit shall be provided with a separate venting chamber to prevent system contaminants from harming the float and venting valve operation.

1. Acceptable manufacturer shall be Spirovent Series HV by Spirotherm, TACO High Velocity 4900, Thrush High Velocity.

### PART 3 – EXECUTION

#### 3.1 TESTING

- A. Test all piping systems to assure they are absolutely leak free.
- B. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and check for leaks. Maintain test for a minimum of 24 hours. The piping system must remain absolutely tight during this period. The satisfactory completion of any test or series of tests will not relieve the contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories. The test should be observed by the Architect / Engineer before pressure is removed and water drained.

#### 3.2 AIR HANDLING UNIT PIPING

- A. Provide a minimum of 12" of straight pipe at all coil piping connections.

#### 3.3 AIR SEPARATOR

- A. Install full size drain to nearest floor drain.
- B. Install air vent drain to nearest floor drain.

END OF SECTION

SECTION 23 21 23

HVAC PUMPS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 23 - Mechanical.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 23 - Mechanical, including the following:

- A. Division 23 Mechanical - Electrical Provisions of Mechanical Work.
- B. Section 23 05 48 HVAC Vibration Isolation
- C. Section 23 05 50 Noise Control for Mechanical Systems

1.3 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.
- E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.
- F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.
- G. Select the pump for operation at or near peak efficiency.
- H. Cavitation-free at all points on the curve.
- I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.
- J. Pumps shall be suitable for parallel operation. Where pumps are operated in parallel, individual pumps shall be capable of stable operation with only one pump operating in the system. Submit pump curves with single and multiple pumps operating on system curve for approval.

1.4 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. The head capacities indicated in the schedules are listed for bidding purposes only. Calculate the operating head at each pump; take into consideration the actual routing of the various lines, pressure drops in heat exchangers and coils, exact lengths of pipe, fittings, etc. Submit these

calculations, together with copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

## 1.5 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. When multiple pumps are operating in parallel, show pump curves for one pump running, two pumps running, and so on. Show pump curves with system curve plotted.

## 1.6 DELIVERY OPTIONS

- A. Manufacturer shall provide quick shipment options to minimize product lead times.

# PART 2 – PRODUCTS

## 2.1 VERTICAL IN-LINE (VIL) PUMPS

- A. Pump Construction:
1. Pump casing, cast iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig at 150°F and ductile iron with 250 psig ANSI / PN25 flanges for working pressure to 375 psig at 150°F.
  2. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
  3. Impeller: Bronze, fully enclosed type; dynamically balanced, two-plan balancing is required where installed impeller diameter is less than 6 times the impeller width.
  4. Shaft: Provide 316 stainless steel pump shaft.
  5. Coupling: Rigid spacer type of high tensile aluminum alloy. Coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
  6. Mechanical seals shall be stainless steel multi-spring inside or outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel glad plate. Provide factory installed flush line with manual vent.
  7. Split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positive cooling and lubrication.
  8. Provide seal flush supply line to the mechanical seal with a 50 micron cartridge filter and sight flow indicator to suit the working pressure encountered. Filters shall be changed by the installing contractor after system is flushed and on a regular basis until turned over to the Owner.
  9. Supply in the flush line to the mechanical seal a maintenance free sediment separator with sight flow indicator.
  10. Natatorium pumps shall utilize a cast 316 stainless steel impeller and a ductile iron casing with fusion bonded epoxy coating to withstand corrosion caused by chlorinated water.
- B. Single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.
- C. Pump Motor:
1. Premium efficiency
  2. Totally enclosed fan cooled
  3. Cast iron frame and end plate
  4. (2) Forge steel lifting eye
  5. Over-sized conduit box with ground lug
  6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve.
  7. Critical speed of the pump shall be at minimum 115% of the operating speed listed in the pump schedule.

8. Designed for Variable Frequency Drive Application
9. Greaseable bearings rated for a minimum of 200,000 hours.
10. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%
30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

- D. Data plates:
  1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
  2. Locate the nameplate for easy visibility.
  3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
    - a. Manufacturer, address, telephone number
    - b. Pump model number
    - c. Pump serial number
    - d. Size (including impeller diameter scheduled in inches)
    - e. Type
    - f. Equipment designation as listed on the pump schedule.
    - g. Flow scheduled (gallons per minute)
    - h. Dynamic head scheduled (feet of water)
    - i. Efficiency (percent)
    - j. Shut-off head (feet of water)
    - k. Speed (rpm)
    - l. Brake horsepower
    - m. Maximum brake horsepower with rated impeller
    - n. Rotation
    - o. Maximum allowable pressure (psig)
- E. The schedule on the drawing sets forth the type of pump and GPM required.
  1. The head capacities and horsepower are for bidding purposes only.
  2. Make pump selection based on actual system calculations.
- F. Acceptable manufacturers:
  1. Bell & Gossett
  2. Armstrong Series 4300
  3. Aurora
  4. Taco
  5. Grundfos
  6. Patterson

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
  1. Provide a minimum of 24" access space around pumps for service.
  2. Install pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Install stainless steel drain pan with trough under chilled water pumps only.
  3. Provide air cock and drain connection piped to floor drain.
  4. Lubricate pumps prior to start-up.

5. Install condenser water pumps to ensure a full flooded suction.
  6. Paint entire unit with two coats of machinery enamel after completion of installation.
  7. Provide a spool piece between the suction diffuser and the suction side of the pump minimum length 8" face to face.
  8. Provide pressure taps with valves on each side of the pump.
  9. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
  10. Reference section 23 05 13 Article 3.1 paragraph D for motor wiring connectors.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge. Provide an automatic air vent off the pump casing. For base mounted pumps, provide a drain line the full size of the base connection and extend it to and terminate it over the nearest floor drain.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Ensure pumps:
1. Operate at specified system fluid temperatures without vapor binding and cavitation.
  2. Are non-overloading in parallel and individual operation.
  3. Operate within 25 percent of midpoint of published maximum efficiency curve.
- E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

### 3.2 MANUFACTURER START-UP SERVICE ALIGNMENT

- A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
1. Technicians, as required, shall be trained and experienced in the work they perform (contractor start-up / alignment is unacceptable).
- B. Before starting pumps, but after connecting piping:
1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
  2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
  3. Submit readings for approval.
  4. Include the approved readings in the Owner's Maintenance Manual.

### 3.3 FINAL PUMP FLOW CALIBRATION

- A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
  2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.
- B. Enter the information on the final configuration of the pump in the Owner's Manual.
1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

### 3.4 SPARE PARTS

- A. Provide the following spare parts and material to the Owner for his use after the warranty period.
1. An extra packing box rebuild kit and 5 packing rings for each condenser water pump.
  2. An extra mechanical seal for each vertical inline pump.
  3. A set of bearings for each horizontal pump.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING AND APPURTENANCES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

- A. Division 23 Mechanical.
  - 1. Pipe and Pipe Fittings
  - 2. Piping Insulation

PART 2 – PRODUCTS

2.1 PIPE AND FITTINGS

- A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

- A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.
- B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

- A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.
- B. Use valves with a bronze body and sweat-type connections.
- C. Provide stainless steel stem and plunger assembly and a stainless steel piston.
- D. Furnish sealed and moisture proof solenoid coils.
- E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

- A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

- A. Furnish replaceable core liquid line filter dryer.
- B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

PART 3 – EXECUTION

3.1 BRAZING

- A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

REFRIGERANT PIPING AND APPURTENANCES



### 3.2 PRESSURE TEST

- A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
  - 1. Test joints with a Halide torch or an electronic leak detector.
  - 2. Repair leaks and retest each system until proved tight.

### 3.3 EVACUATION AND DRYING

- A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.
  - 1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
  - 2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

### 3.4 PIPE SIZE

- A. Pipe shall be routed and sized per condensing unit manufacturer's instructions.

END OF SECTION

SECTION 23 25 13

CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide equipment, chemicals and treatment materials for the complete water treatment system.
- B. Determine which chemicals to use from the results of a water sample analysis taken from the building domestic water supply.
- C. Provide water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for each system specified.
  - 1. Closed chilled and hot water systems
  - 2. The cooling tower condenser water system
- D. Entire existing chilled water system shall be fully cleaned and flushed prior to the operation of chillers.
- E. Test all existing closed and open water systems and provide report to Owner and Engineer.

1.2 SERVICE AND SUPPLIES

- A. All work shall be performed by a qualified, full-time, Water Program Manager.
  - 1. Specialist in the field of industrial water treatment.
  - 2. Facilities include water analysis laboratory, development facilities and service department.
- B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride) for field use including test equipment and reagents as required for specific use with the treatment products employed.
- C. Where specialized supplementary testing or control equipment is required, provide appropriate items.
- D. Provide a water management and service program for a period of one year beginning at substantial completion. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.
- E. Routing Services
  - 1. Check and adjust water treatment system operation.
  - 2. Instruct, train and advise operating personnel.
  - 3. Check efficiency of chemicals and chemical applications.
  - 4. Replenish chemicals and replace expendables.
  - 5. Clean or replace filter in feeder.
- F. Chemically clean the piping system.
- G. Provide a complete laboratory analysis of water samples. Insert in the Owner's manuals.
- H. Provide review of report figures in the field water testing.

1.3 QUALITY ASSURANCE

- A. Acceptable program manager shall have:
  - 1. Research and development facilities.
  - 2. Regional laboratories capable of making water analysis.
  - 3. A service department and qualified technical service representatives located within a reasonable distance of the project site.
  - 4. Service representatives who are registered Engineers or factory-certified technicians with

CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

not less than 5 years of water treatment experience with the water treatment system manufacturer.

- B. Ensure that all products, packaging, blow-down or other effluents do not violate local, state, or federal laws or regulations. Use only chemicals that are registered, when required, with the U.S. Department of Agriculture or the U.S. Environmental Protection Agency and that are labeled as required by law.
- C. Provide electrical products that have been tested, listed and labeled by Underwriters Laboratories and comply with the National Electrical Manufacturers Association Standards.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Nalco Water – Ecolab (Danny Short 832-823-9716 [danny.short@ecolab.com](mailto:danny.short@ecolab.com) )

### 2.2 CLOSED CHILLED AND HOT WATER SYSTEM

- A. Side stream stainless steel filter feeders in the hot water and chilled water systems:
  - 1. Rated at 40-gpm capacity.
  - 2. Operating conditions: 200 psig and 250°F.
  - 3. Single filter cartridge.
  - 4. Cartridge #:
    - a. NALCO 231-FMPIC405HT
    - b. WATTS #FMPIC405HT
  - 5. Fabricated hot dipped galvanized steel support legs and frame. Refer to detail drawing for requirements.
  - 6. Provide sufficient quantity of filter cartridges for warranty period. Minimum of two additional cartridges provided to owner.
  - 7. Provide (2) two drains for filter housing. (1) clean water drain, (1) dirty water drain.
- B. Acceptable Manufacturers: Side Stream Cartridge Filter Housing
  - 1. NALCO #231-FMJCH40
  - 2. WATTS #FMJCH40
- C. Treatment chemicals:
  - 1. Furnished as a concentrated liquid in 5 gallon pails
  - 2. A corrosion inhibitor of the nitrite-borate type equal to Nalco 2534.
  - 3. Maintained at a nitrite residual of 600 – 800 ppm in chilled loops and 1000-1500 in hot loops.
  - 4. With effective copper and black iron corrosion inhibitors.
  - 5. Form a protective film to prevent corrosion and scale formation.
  - 6. Have colored dye to indicate presence.
  - 7. Compatible with all system elements.
- D. Multiple chemicals used in a common system shall be compatible.

## PART 3 – EXECUTION

### 3.1 INSTALLATION/START-UP

- A. In accordance with manufacturer's recommendations.
- B. Anchor the chemical filter feeder to a concrete housekeeping pad using wedge type expansion anchors.
- C. Clean and flush closed loops systems.
  - 1. Clear water flush systems before introducing chemical cleaners.
  - 2. Chemical cleaner shall be introduced into the systems to remove construction related oils, greases, threading compounds, and silt.

#### CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

3. Chemical Cleaner shall passivate and pre-film pipe system.

### 3.2 WATER ANALYSIS

- A. The chemical treatment agency shall provide the services of a testing laboratory to perform a site water analysis. As a minimum, conduct the following tests in accordance with ASTM standards and to the satisfaction of the Owner/Architect/Engineer.
  1. Silica in water and wastewater.
  2. Acidity or alkalinity of water.
  3. Iron in water.
  4. Hardness of water.
  5. Ph of water.
  6. Particulate and Dissolved Matter, Solids or Residue in Water.
  7. Turbidity in water.
  8. Corrosivity of water in absence of heat transfer.
  9. Standard practices for sampling water.
- B. Take water samples in accordance with ASTM.
- C. Prepare a test report in accordance with ASTM for each of the tests conducted.
- D. Submit the test reports to the Architect/Engineer.

### 3.3 CHEMICAL TREATMENT

- A. The chemical treatment agency shall provide complete services necessary for chemically cleaning and treatment the following systems:
  1. Chilled water.
  2. Hot water.
- B. The chemical treatment agency shall provide, but not be limited to the following:
  1. Equipment and installation.
  2. Chemicals.
  3. Analytical and testing work.
  4. Inspection.
  5. Calculations.
  6. Assistance to the trade installing the piping.
  7. Instruction to Owner.
- C. Determine which chemicals to use from the results of site water analysis. Provide the chemical necessary to achieve the desired water condition.
- D. Examine and supervise flushing and pipe cleaning operations and verify that the systems are clean, free of debris and rust and other construction materials before starting water treatment.
- E. After the piping has been flushed, cleaned, rinsed and charged with chemicals, then start-up and operate the chemical treatment equipment to provide steady, stable characteristics for the systems treated.
- F. During construction, instruct the Contractor in the field piping and wiring of chemical feeding equipment. If such piping and wiring details are not shown on the Contract Drawings, then provide all equipment, piping, wiring, instrumentation and chemicals to provide a complete and operating system without additional cost.
- G. After the chemical treatment is functioning as intended, the chemical treatment agency shall demonstrate to the Architect/Engineer the chemical treatment operation.

### 3.4 OWNER TRAINING

- A. A chemical treatment agency, in conjunction with the chemical treatment equipment manufacturer's factory representative, shall train the Owner to operate and maintain the chemical treatment system

## CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

as a whole and in part for each piece of equipment.

- B. Furnish to the Owner a chemical treatment administration manual covering the chemical treatment program for each of the systems treated. The manual shall include, but not be limited to:
1. Name, address and telephone number of the chemical treatment agency and each of the equipment manufacturers.
  2. Operation and maintenance manuals.
  3. Test reports.
  4. Chemical data sheets.
  5. A narrative describing the chemical treatment program for each of the systems being treated.

### 3.5 TESTING AND INSPECTION

- A. After the systems have been accepted, the chemical treatment agency shall visit the site every month during the warranty period.
- B. During each visit:
1. Check and adjust the chemical treatment equipment.
  2. Check the chemistry of the treated system to confirm the chemicals are maintaining the system as intended.
  3. Advise and instruct the Owner on operational changes made to the chemical treatment program.
  4. Take a water sample of each system being chemically treated and have the samples tested by a testing laboratory. Prepare a report for each water sample and submit it to the Owner. Include in the test report the changes that need to be made to the chemical treatment program.
  5. Maintain complete records of the treatment program for each system at the project site. Keep the records in a hardbound manual with the building manager. A second copy shall be maintained by the agency for the agency's records.
- C. Routine visits must be coordinated with the Owner.
- D. Send copy of monthly report to Engineer for Verification.

END OF SECTION

SECTION 23 31 13

DUCTWORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

- A. Division 23 Mechanical
  - 1. Air Devices
  - 2. Air Handling Units
  - 3. Insulation
  - 4. Terminal Units
  - 5. Fan Coil Units
  - 6. Fans
  - 7. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.
- C. Duct cleaning: Oil film on sheet metal should be removed before shipment to site. On-site, inspect ducts to confirm that no oil film is present. Remove any oil. If ducts contain dust and dirt, clean them immediately, prior to substantial completion and prior to using the ducts to circulate air. HVAC system components or duct work may only be cleaned, coated, or have applied to its surface disinfectants, pesticides or biocides that are registered and particularly labeled for use in HVAC systems by state and federal EPA.

1.4 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.
- B. Submit product data and sealing materials to be used.
- C. Submit sound attenuation data.
- D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

## PART 2 - PRODUCTS

### 2.1 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

### 2.2 DUCT MATERIAL AND CONSTRUCTION

- A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.
- B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.
- C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
  - 1. Galvanized
- D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.
- E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.
- F. Shower Area Exhaust Systems: Welded 304 Stainless steel.
- G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge

### 2.3 ACOUSTICAL DUCT

- A. Duct and fittings:
  - 1. Double wall acoustically treated.
  - 2. Annular space packed with fiberglass insulation.
  - 3. Perforated metal liner to provide specific acoustic impedance
  - 4. Insulation 1.0 pcf. 1 inch thick
  - 5. United McGill Acousti-K27 spiral lockseam or approved equal
  - 6. Material as indicated below:
    - a. Paintable Galvanized Steel
- B. Pressure rating and tests as specified for single wall ductwork.

### 2.4 DUCT SEALING OF SEAMS AND JOINTS

- A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams

made air tight with duct sealer.

1. Indoor applications – Foster 32-14
2. Outdoor applications – Foster 32-17

## 2.5 FLEXIBLE DUCT LOW PRESSURE

- A. Construction:
1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
    - a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
  2. UL 181 Class I air duct label
  3. Reinforced vapor barrier jacket
  4. Rated for use at system pressure (6" wc minimum)
  5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.
- B. Fire hazard classification:
1. Flame spread rating 25 maximum.
  2. Smoke developed rating 50 maximum.
- C. Thermal characteristics:
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
  2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
  3. 2" minimum wall thickness insulation with 1" overlap
- D. Acceptable manufacturers:
1. Flexmaster
  2. Peppertree Air Solutions

## 2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

- A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
- B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:  
Positive: 12" w.g.  
Negative: 5" w.g.
- C. The duct shall be rated for a velocity of at least 5500 fpm.
- D. Suitable for operating temperature range of -20°F to +250°F.
- E. Factory insulate the flexible duct with fiberglass insulation.
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
  2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
  3. 2" minimum wall thickness insulation with 1" overlap
- F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.
- G. Acceptable manufacturers:
1. Flexmaster
  2. Peppertree Air Solutions

## 2.7 FIRE DAMPERS

- A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.



- B. Acceptable Manufacturers:
  - 1. Ruskin
  - 2. Prefco Products
  - 3. Air Balance
  - 4. Greenheck, Inc.
  - 5. Nailor Industries
  - 6. Pottorff
  - 7. Price

## 2.8 CEILING RADIATION DAMPERS

- A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.
- B. Acceptable Manufacturers
  - 1. Ruskin
  - 2. Prefco
  - 3. Air Balance
  - 4. Phillips
  - 5. Safe-Air
  - 6. Nailor Industries

## 2.9 WALL LOUVERS

- A. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
- D. All louvers shall be certified to meet the wind zone requirements of project location.
- E. Acceptable manufacturers:
  - 1. American Warming and Ventilation
  - 2. Arrow
  - 3. Greenheck
  - 4. NCA
  - 5. Pottorff
  - 6. Ruskin

## 2.10 FLUES FOR POWER EXHAUST AND HIGH EFFICIENCY BOILERS AND WATER HEATERS

- A. Double wall air insulated positive pressure chimney equal to Metalbestos, Van-Packer, Schebler or Metal-Fab. Chimney shall be rated for 550°F maximum flue gas temperature and with a UL tested pressure rating of 40 inches w.c. The interior pipe shall be constructed of AL 29-4C stainless steel and the exterior pipe shall be constructed of 304 stainless steel. Stack system shall be complete with a one inch air gap between inner liner and outer cover. Chimney shall be constructed and installed per UL-1738 and NFPA-211. All accessories shall be made by the same manufacturer and designed to be a part of a positive pressure chimney system.

## 2.11 DUCT LINING

- A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

## 2.12 VOLUME DAMPERS

- A. Manual balancing dampers that meet or exceed the following minimum construction standards:
  - 1. Frame 16-gauge
  - 2. Blades 16-gauge
  - 3. Bearings corrosion resistant
  - 4. Concealed linkage
  - 5. Opposed blade dampers
- B. Acceptable manufacturer:
  - 1. Ruskin Model MD-35 or approved equal, by
  - 2. Arrow
  - 3. American Warming and Ventilating
  - 4. Nailor Industries
  - 5. Pottoroff

## 2.13 ACCESS DOORS

- A. Round spin-in door of galvanized steel.
  - 1. Fire proof sealing gaskets and quick fastening locking devices
  - 2. Insulated door
  - 3. Conform to the requirements of the NFPA
  - 4. Identification and use of each access door
  - 5. UL label to match the construction in which it is installed
  - 6. Cable attached to door and outer frame
  - 7. Low leakage Access Door
- B. Acceptable Manufacturer
  - 1. Flex master, Inspector Series
  - 2. Approved Equal

## 2.14 COMBINATION FIRE/SMOKE DAMPERS

- A. Combination fire/smoke dampers meeting the following requirements:
  - 1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
  - 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
  - 3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
  - 4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high

- temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
- 5. Provide UL555S qualified electric actuator at 120 VAC.
  - 6. Provide air-foil type blades.
- B. Provide integral sleeves
- C. Acceptable Manufacturers:
  - 1. Ruskin
  - 2. Air Balance, Inc.
  - 3. Greenheck, Inc.
  - 4. Nailor Industries
  - 5. Pottoroff
  - 6. Price

## 2.15 SMOKE DAMPERS

- A. Smoke dampers meeting the following requirements.
  - 1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
  - 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
  - 3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
  - 4. Provide UL555S qualified electric actuator at 120 VAC.
  - 5. Provide air-foil type blades.
- B. Provide integral sleeves.
- C. Acceptable Manufacturers:
  - 1. Ruskin
  - 2. Air Balance, Inc.
  - 3. Greenheck, Inc.
  - 4. Nailor Industries
  - 5. Pottoroff
  - 6. Price

## 2.16 DIFFUSER FITTINGS LOW PRESSURE TAPS

- A. Fitting shall meet or exceed the following minimum construction standards:
  - 1. Conical with a base diameter two inches larger than the tap diameter.
  - 2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
    - a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
    - b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
    - c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
  - 3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
    - a. Through 8 inches: 26 gauge; Damper blade 22 gauge

- b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
- c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
- d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
- 4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
- 5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
- 6. Provide the damper with a self-locking regulator and handle.
- 7. Provide a 2" sheet metal stand-off to extend the regulator.
- 8. Flex duct grip area – 2 inches behind retaining bead
- 9. Flex duct retaining bead – 1 inch from end
- 10. Conical length of at least 3 inches
- 11. Barrel length of at least 9 inches

## 2.17 AUXILIARY DRAIN PANS

- A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
- H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
- I. Install end bearing at all location where damper shaft penetrates duct wall.
- J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

### 3.2 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.

- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.
- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
  - 1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
  - 2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.
- E. Use pushrod operator with locking nut and butt hinges assembly.
- F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
  - 1. Return air ductwork
  - 2. Outside air branch duct
  - 3. Exhaust branch duct
  - 4. Exhaust connections to hoods except kitchen grease hoods or equipment
  - 5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
  - 6. At each outside air and return air duct connection to plenum of constant volume units
  - 7. At discharge side of constant volume boxes
  - 8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
  - 9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.
- G. Elbows:
  - 1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
  - 2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.
- H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.
- I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.
- J. Insulated Flexible Duct:
  - 1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.

2. Construct bends over 45° with sheet metal elbows.

K. Duct Supports:

1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

- L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

3.3 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
1. Fire Dampers
  2. Smoke Dampers
  3. Smoke/fire Dampers
  4. Outside Air Dampers
  5. Duct Mounted Coils (up-stream and downstream)
  6. Control Dampers
- B. Size access door 1" smaller than ductwork.
1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.6 DUCT LINING

- A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
- B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.
- C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.
- D. Do not install liner in multi-zone unit ductwork.

### 3.7 SEALING OF SEAMS AND JOINTS

- A. Seal supply, return, exhaust and outside air duct systems.

### 3.8 FLUES

- A. Provide and install flues for all gas fired equipment.
- B. Refer to plans for all related locations.
- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.
- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.
- E. Terminate flues at height above roof to prevent flue gas from entering the building.

### 3.9 DISHWASHER HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the washer.

### 3.10 SHOWER AREA EXHAUST SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot slope down to grille connection. Install in accordance with Fig. 2-21 of SMACNA HVAC Duct Construction Standards.

### 3.11 KITCHEN EXHAUST DUCT

- A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

### 3.12 FUME HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 stainless steel construction.

### 3.13 ACOUSTICAL DUCT

- A. Install in the following locations:
  - 1. Where indicated on the drawings

#### 3.14 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

#### 3.15 CONNECTIONS TO LOUVERS

- A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.
- B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

#### 3.16 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross braced and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.
- B. Provide access doors.

#### 3.17 AUXILIARY DRAIN PANS

- A. All condensate producing equipment installed above ceilings and in central plant area shall be provided with a welded stainless steel secondary drain pan installed below equipment entirely and extend a minimum of 4" beyond equipment footprint.
- B. With 3/4" welded nipple.
- C. Piped to local floor drains or floor sinks.

#### 3.18 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.
- D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

#### 3.19 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

- A. As the project progresses, test the ductwork in sections.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers,



traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

- C. Finally as a complete system, test ductwork at a minimum of 2.5" with a maximum allowable leakage of 1% of the total design supply airflow.
- D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION

SECTION 23 34 16

FANS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

- A. Division 23 Mechanical:
  - 1. Ductwork
  - 2. Vibration Isolation
  - 3. Air Balance
  - 4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.

1.4 SUBMITTALS

- A. Submit fan performance curves with system operating point plotted on curves.
- B. Submit manufacturer's printed installation instructions.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cook
- B. Greenheck
- C. Penn Barry Ventilator
- D. Twin City Fans

2.2 PROTECTIVE COATINGS

- A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.
- B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

FANS

## 2.3 SUPPLEMENTAL EQUIPMENT

- A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.
- B. Belt Drives:
  - 1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
  - 2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
  - 3. Provide belt guards and apply the same finish as used on the fan.
  - 4. Oil and heat resistant, nonstatic type belts.
  - 5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.
- C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.
- D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.
- E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.
- F. Where motorized damper is scheduled:
  - 1. The motor and damper are specified in the Building Management and Control System Specification.
- G. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
  - 1. Fan mark as indicated on the Contract Drawings.
  - 2. Serial number
  - 3. Model number
  - 4. Capacity (CFM) and static pressure.
  - 5. Motor HP
  - 6. Motor Amps
  - 7. Manufacturer
  - 8. Motor phase
  - 9. Number of Belts/Make/Size
  - 10. Motor volts

## 2.4 VENTILATION AND EXHAUST FANS

- A. Provide the ventilation and exhaust fans shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Provide approved safety screen where inlet or outlet is exposed.
- D. Provide duct flanges where required for connections.
- E. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
- F. Furnish supply fans with 1" aluminum, washable filter section.

## 2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

- A. Provide the rooftop ventilation and exhaust systems shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Components:
  - 1. Aluminum, stainless steel or plastic coated bird guard.
  - 2. Screws and fasteners of stainless steel or nonferrous material.
  - 3. All aluminum construction unless indicated otherwise on fan schedule.
- D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine allow aluminum.
- E. Aluminum base shall be continuously welded curb cap corners.

## 2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

- A. Provide the rooftop intake and relief vent systems shown on the drawings.
- B. Provide with aluminum, stainless steel or plastic coated bird guard.
  - 1. Screws and fasteners of stainless steel or nonferrous material
  - 2. All aluminum construction
- C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
- D. Aluminum base shall be continuously welded curb cap corners.

## 2.7 OSCILLATING AIR CIRCULATOR FAN

- A. three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100
- B. Totally enclosed motor voltage – 120 Voltage – 60 Hz
- C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard
- D. Wall Mounted
- E. Factory wired 10', 3 conductor with ground molded plug
- F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

## 2.8 AUXILIARY ANGLE FILTER

- A. Provide a duct mounted inline low velocity angled filter box for the outside air supply systems.
- B. Filter box shall be upstream of any ductwork taps to VAV boxes.
- C. Maximum pressure drop shall be 0.5 inches static pressure.
- D. Provide continuous filter rails and a double wall hinged access door to allow easy filter replacement.
- E. Filter box shall be installed with a maximum height of 6'-0".
- F. Standard sizes 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings.

- B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
- C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x 1/4" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.
- D. Install curbs and equipment in level position.
- E. Ceiling mounted in-line centrifugal blowers
  - 1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
  - 2. Provide sub-structure where required.
  - 3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

### 3.2 EXTRA MATERIALS

- A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION

SECTION 23 35 16

WELDING FUME EXHAUST SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide the multi-position welding fume exhaust system.
- B. Construct according to the Industrial Ventilation Manual.
- C. System capacity as scheduled.

1.2 SUBMITTALS

- A. Submit product data sheets of the vibration isolation.
- B. Submit a 3' long sample of the flexible exhaust hose, together with product data sheet.
- C. Submit shop drawings of the entire duct system and components.
- D. Submit shop drawings on structural supports.
- E. Submit fan performance curve for each fan.
  - 1. Plot fan volume against static pressure, horsepower and efficiency.
  - 2. Show point of rating based on static requirements of the system.
- F. Submit product data sheets on the electrostatic air cleaner.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Car-Mon
- B. Monoxivent
- C. National
- D. AAF
- E. Systems of Garage Ventilation

2.2 OUTDOOR DUCTWORK

- A. Ductwork outdoors welded watertight.
  - 1. Coat welded areas with cold galvanizing compound.
- B. Paint with two coats of industrial fume resistant enamel.
  - 1. Galvanize prime coat.

2.3 INDOOR DUCTWORK

- A. Tapered galvanized duct system.
- B. 10' long flexible exhaust hoses at each position.
  - 1. Fiberglass/neoprene with coated steel coil.
  - 2. Outside weld proof Mylar coating.
  - 3. Fire proof.
  - 4. Resistant to puncture by hot welding rod.

WELDING FUME EXHAUST SYSTEM

- C. Four inch diameter fume receptor with screen and magnets for each position.
  - 1. Provide magnets with sufficient strength to support the receptor and hose when suspended from the bottom of a metal plate.

## 2.4 SLOTTED FUME HOODS

- A. 18 gauge welded stainless steel construction.
- B. Exhaust outlet size shall be full size of connected ductwork. Refer to drawings.
- C. Provide manual balancing damper on outlet of hood.
- D. Hood length as indicated on drawings.

## 2.5 INTERNAL SUPPORT SOURCE CAPTURE ARM

- A. Internally supported source capture arm with a minimum of four pivot points and 180 to 360 degrees swivel.
- B. Arm shall be provided with internal support structure, weld proof hose (300°F rated), mounting brackets, and collection hood.

## 2.6 ELECTROSTATIC AIR CLEANER

- A. Provide high efficiency electrostatic filtration.
  - 1. Solid state voltage limiting power pack.
  - 2. Primary and Secondary status lights.
  - 3. Safety interlock.
- B. Provide a charge neutralizer for the heavy concentrations of metallic particulate in the weld fume.
  - 1. Power supply to activate the ionizing wires on the collector cells.
- C. Provide an inlet filter as specified in Section 23 41 00.
- D. Provide with exhaust fan as specified.

## 2.7 EXHAUST FAN

- A. Drive assembly:
  - 1. Sized for 50% overload.
  - 2. Matched belts.
  - 3. Adjustable pitch motor pulley and fixed pitch fan pulley.
  - 4. Cast iron pulleys keyed to the shaft.
  - 5. Totally Enclosed Fan Cooled inverter duty motor.
  - 6. Ventilated, steel, weatherproof drive cover.
- B. Fan shall be:
  - 1. Statically and dynamically balanced.
  - 2. Selected for the design air quantities and pressure of the system.
  - 3. Selected to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- C. Select the motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Fan construction:
  - 1. Backward inclined wheel.
  - 2. Non-overloading.
  - 3. Paint all parts exposed to the air stream with phenolic resin protective coating.

## 2.8 VIBRATION ISOLATION

- A. Mount the exhaust fan and motor on a common vibration isolation base selected for the fan frequency.
  - 1. Adjustable slide rail for belt tension adjustment.
  - 2. Housed adjustable springs.
- B. Weatherproof all vibration isolation outdoors.
  - 1. Hot dipped galvanize steel parts.
  - 2. Zinc plated bolts.
  - 3. Zinc plate and neoprene coat all springs.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Installation as per manufacturer's recommendations.

END OF SECTION





SECTION 23 36 16

VARIABLE VOLUME TERMINAL UNITS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install variable volume terminal units, including hangers, controls and other required elements.
  - 1. Provide parallel flow fan powered variable volume terminal units where indicated on the drawings.

1.2 RELATED WORK

- A. Division 23 Mechanical.
  - 1. Ductwork.
  - 2. Air Balance.
  - 3. Electrical Requirements for Mechanical Work.
  - 4. Building Management and Control System.
  - 5. Vibration Isolation.

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.
- B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

1.4 SUBMITTALS

- A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order. Submit internal wiring diagrams, installation and operation manual as a complete submittal package.
- B. Submit certified sound power levels for both discharge sound and casing radiated sound in accordance with ARI 880-98 Certification Program. All NC levels shall be calculated using ARI 885-98, Appendix E attenuation factors for mineral ceiling.
- C. Submit for each box the following information:
  - 1. Box size
  - 2. Inlet size
  - 3. Box number
  - 4. Box designation
  - 5. Minimum / Maximum Fan CFM
  - 6. L / R Coil connection
  - 7. GPM
  - 8. Motor HP
  - 9. NC Level
  - 10. External Static Pressure
  - 11. Scheduled MBH
  - 12. Actual MBH
  - 13. Heating Coil Pressure Drop (ft.)
  - 14. Entering and Leaving Water Temperature
  - 15. Entering and Leaving Air Temperature

1.5 QUALITY ASSURANCE

- A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.

VARIABLE VOLUME TERMINAL UNITS

- B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.
- C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS:

- A. Titus.
- B. Krueger
- C. Price
- D. Nailor
- E. Metalaire

### 2.2 BOX CONSTRUCTION

- A. Galvanized 20 gauge steel casing with suspension lugs.
- B. Lined with minimum 1.5 PCF / 1" thick fiber free
  1. Flame spread not higher than 25.
  2. Smoke developed rating not higher than 50.
  3. Condensation on the exterior of the box is not approved.
  4. Coat all cut edges of liner with NFPA approved sealant.
  5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.
- C. Provide access to controls, fan compartment, and unit servicing, without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.
- D. Components shall be constructed of corrosion resistant materials.
- E. Bearings shall not require lubrication.
- F. Casing leakage shall not exceed 2.0% of scheduled design air flow at 3.0" WG interior casing pressure.
- G. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.
- H. The maximum overall height of the variable air volume unit shall not exceed available ceiling space.
- I. Maximum static pressure drop of air through terminal box shall be 0.2" w.g.
- J. Maximum velocity through duct inlet shall be 2,000 fpm.
- K. Terminal unit shall be provided with access to the entering side of the coil for coil cleaning.

### 2.3 COMPONENTS

- A. The entire terminal unit, including the heating coil, shall be designed and built as a single unit.
- B. Provide each unit with a primary variable air volume damper that controls the air quantity in response to a space sensor or building management and control system.
- C. Each unit shall contain:
  1. Fan and motor assembly. For Fan Powered Units Only
  2. Heating coil.
- D. Locate the heating coil in the discharge of the blower section.
- E. Provide single point electrical connections for the entire unit. Entire assembly shall be UL or ETL Certified, electrical components shall be UL listed and installed in accordance with the National Electrical Code.

- F. The variable air volume units provided by the manufacturer shall be the quietest design available from the manufacturer for the type specified.
- G. Induced air filter frame for 1" thick disposable filter. The filter shall be sized to match the district filter sizes. Where the standard size is not available the manufacturer shall provide an adapter kit to allow the district standard sizes to be utilized. The details of this kit shall be submitted in the submittal package.
- H. Sufficient power for the VAV unit DDC controller, electric actuator and other components necessary to satisfy the sequence of operation. Size each transformer for the total connected load plus an additional 25% of the connected load. Primary and secondary fuses housed in a fuse block.
- I. Inlet attenuator for induction airside of box with liner to lower radiated noise.

#### 2.4 BLOWER FAN AND MOTOR

- A. Blower fan:
  - 1. Constructed of steel.
  - 2. Forward curved centrifugal wheel.
  - 3. Dynamically balanced wheels.
  - 4. Direct drive motors.
- B. Motor
  - 1. Ultra-high efficiency ECM motor technology
- C. Motor current characteristics as scheduled. Coordinate motor voltage with Division 26. Verify voltage with Electrical Plans.
  - 1. Thermal overload protection.
  - 2. Sleeve bearings.
- D. Provide isolation between fan motor assembly and unit casing.
- E. Provide a manual speed control system to allow continuously adjustable fan speed from maximum to minimum.
  - 1. Electronic speed control matched to operate with the motor.
  - 2. Speed controller shall incorporate a minimum voltage stop to ensure motor cannot operate in a stall mode.
- F. Fan disconnect switch. This is not to be used as a main disconnect switch.
- G. Provide electric heating models with the following items:
  - 1. Single point electrical connection
  - 2. Line side disconnect switch
  - 3. Motor fuse
  - 4. Motor disconnect switch
  - 5. Fan SCR and relay
  - 6. Control transformer
  - 7. Air flow switch
  - 8. Heat contactors
  - 9. Thermal Hi-Limit Auto Reset switch

#### 2.5 PRIMARY AIR DAMPER AND ACTUATOR

- A. The control actuator shall vary the primary air damper in response to the control signal.
  - 1. Damper leakage at shutoff shall not exceed 2.0% at 1" WG pressure.
  - 2. Locate the damper inside the unit.
  - 3. Damper connection to the operating shaft shall be a positive mechanical connection.
  - 4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
  - 5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open

#### VARIABLE VOLUME TERMINAL UNITS

- position.
- 6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.
- 7. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
- 8. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.

## 2.6 AIR FLOW CONTROL

- A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
  - 1. Air quantity shall be factory set.
  - 2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
  - 3. Control shall be pressure independent.
  - 4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
    - a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.
  - 5. Provide flow measuring taps and a flow chart with each unit for field balancing air flow.
- B. Hot Water Heating Coils:
  - 1. Provide hot water heating coils sized as scheduled.
    - a. The hot water heating coil is specified to be provided and mounted under the work of this Section.
    - b. Coil access door upstream of coil. Provide metal transition section from CVB to heating coil and provide access door in transition.
    - c. Install coil with supply inlet at bottom and on leaving airside of coil.
    - d. Maximum static pressure drop of water through heating coil shall not exceed 10' w.g.
    - e. Maximum static pressure drop of air through heating coil shall not exceed 0.25" esp

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.
- B. Install each unit in accordance with the manufacturer's printed installation instructions.
- C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
  - 1. Provide sub-structure where required.
  - 2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
  - 3. Install units so that they are level and plumb.
- D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.
- E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.
- F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.

- G. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- H. All installation shall be in accordance with manufacturer's published recommendations.
- I. Provide clearance for inspection, repair, replacement and service. Ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located a minimum of 30 inches from all obstructions (walls, pipe, etc.).
- J. Provide ceiling access doors or locate units above easily removable ceiling components.
- K. Support units individually from structure. Do not support for adjacent ductwork. Terminal units shall be supported using unit's hanger brackets and threaded rods.
- L. Provide a duct access door on the leaving side of the heating coil for coil cleaning. Access shall be position within 6" of leaving side of heating coil.

### 3.2 MISCELLANEOUS CONTROLS

- A. The following equipment items are to be furnished by Building Management and Control System and installed by Terminal Unit manufacturer:
  - 1. Automatic temperature control card (DDC).
  - 2. Damper actuator.
- B. The following equipment items are to be furnished and installed by the Terminal Unit manufacturer:
  - 1. Damper.
  - 2. Multi-point flow sensor.
  - 3. Controller enclosure.
  - 4. Power transformer.
- C. Coordinate the output voltage required by the Building Management and Control System.
- D. Coordinate location of controller enclosure.

### 3.3 ACOUSTICAL PERFORMANCE TEST

- A. Test each size for each type of variable air volume unit furnished on the project.
- B. Test for radiated noise and discharge noise in all operational modes from minimum to maximum primary air settings; at inlet air pressures of 1 and 2 inches water column, and at primary air settings of 20, 40, 60 and 100 percent.
- C. Testing shall be done by an independent testing laboratory. Sound values submitted shall be certified by the laboratory doing the testing. Testing laboratory must be approved by Engineer. Final testing and approval must be witnessed by Engineer.
- D. Testing procedures shall be in accordance with ASHRAE Standard 130-96 and rated in accordance with ARI 880.
- E. Test the unit complete with damper, coils and controls. The unit shall be operational and represent a final version of the units to be installed on the project.
- F. If the units do not meet sound criteria, modify the units and retest at no additional cost to the Owner until the sound criteria is in accordance with Contract Documents. The variable air volume unit manufacturer shall be held liable for the costs associated with construction delays resulting from failed test, not to exceed the purchase order cost.
- G. Sound Levels: Maximum sound power levels resulting from any box shall not exceed the following:

OCTAVE BAND CENTER FREQUENCY, Hz.						
	125	250	500	1000	2000	4000
Radiated SPL db	52	45	40	36	34	33
Discharge SPL db	44	37	31	27	24	22

### VARIABLE VOLUME TERMINAL UNITS

1. Sound power levels are referenced to 10-12 watts.
2. Box inlet static pressure = 1-1/2"
3. No discounting for roof effect, ceiling attenuation, lined duct, division of flow and other similar effects.

#### 3.4 SPARE PARTS

- A. Provide one spare motor for each size box.

END OF SECTION

SECTION 23 36 17

DUAL DUCT VARIABLE VOLUME TERMINAL UNITS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install dual duct variable volume terminal units with mixing attenuator, including hangers, controls and other required elements.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
  - 1. Ductwork
  - 2. Air Balance
  - 3. Electrical Requirements for Mechanical Work
  - 4. Building Management and Control System

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.
- B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.
- C. Coordinate multi-point sensor locations with Building Management Control System contractor.

1.4 SUBMITTALS

- A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order.
- B. Submit for each box the following information:
  - 1. Box size
  - 2. Inlet size
  - 3. Box number
  - 4. Box designation
  - 5. Minimum / Maximum CFM

1.5 QUALITY ASSURANCE

- A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.
- B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.
- C. Sound power levels to occupied space shall not exceed the NC levels specified in 23 05 47 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger
- C. Price
- D. Nailor

DUAL DUCT VARIABLE VOLUME TERMINAL UNITS



E. Metalaire

2.2 BOX CONSTRUCTION

- A. Galvanized 20-gauge steel casing with suspension lugs.
- B. Lined with minimum 1.5 PCF / 1.5" thick fiber free thermal and acoustical insulation.
  - 1. Flame spread not higher than 25.
  - 2. Smoke developed rating not higher than 50.
  - 3. Condensation on the exterior of the box is not approved.
  - 4. Coat all cut edges of liner with NFPA approved sealant.
  - 5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.
- C. Provide access to controls without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.
- D. Components shall be constructed of corrosion resistant materials.
- E. Casing leakage shall not exceed 2.0% of scheduled design airflow at 3.0" WG interior casing pressure.
- F. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.
- G. The maximum overall height of the dual duct variable air volume unit shall not exceed available ceiling space.
- H. Maximum static pressure through box shall not exceed 0.2" w.g.
- I. Maximum velocity through inlets should not exceed 2,000 fpm.

2.3 COMPONENTS

- A. Primary variable air volume damper that controls the air quantity in response to a space sensor.
- B. Multi-point airflow sensors at locations as required by Building Management Control System.
- C. Controller enclosure
- D. Mixing attenuator.

2.4 PRIMARY AIR DAMPER AND ACTUATOR

- A. The control actuator shall vary the primary air damper in response to the control signal.
  - 1. Damper leakage at shutoff shall not exceed 2.0% of the maximum scheduled schedule design airflow at 3" WG inlet static pressure and be tested in accordance with ASHRAE 130.
  - 2. Locate the damper inside the unit.
  - 3. Damper connection to the operating shaft shall be a positive mechanical connection.
  - 4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
  - 5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
  - 6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.

2.5 AIR FLOW CONTROL

- A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
  - 1. Air quantity shall be factory set.

DUAL DUCT VARIABLE VOLUME TERMINAL UNITS

2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
3. Control shall be pressure independent.
4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
  - a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.
5. Coordinate flow sensor locations with Building Management and Controls Contractor.
6. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
7. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.
8. Flow sensor tubing to be connected with brass barb fittings.
9. Tubing from air flow sensor to DDC controller shall be Tygon tubing (no exceptions)

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.
- B. Install each unit in accordance with the manufacturer's printed installation instructions.
- C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
  1. Provide sub-structure where required.
  2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
  3. Install units so that they are level and plumb.
- D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.
- E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.
- F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.

#### 3.2 MISCELLANEOUS CONTROLS

- A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
  1. Automatic temperature control card (DDC).
  2. Damper actuator.
  3. Discharge air temperature sensor
- B. The following equipment items are to be furnished and installed by the Dual Duct Unit manufacturer:
  1. Damper.
  2. Multi-point flow sensors.
  3. Controller enclosure.
  4. Tubing from air flow cross to DDC controller.
  5. Factory provided external taps for air flow readings with corresponding chart/label on box near dampers.
  6. Mixing attenuator.
- C. Coordinate location of controller enclosure, inlet sensors, wiring of terminal equipment controller and transformer required by the Building Management and Control System contractor.

#### DUAL DUCT VARIABLE VOLUME TERMINAL UNITS

END OF SECTION

SECTION 23 37 13

AIR DEVICES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

- A. Division 23 Mechanical.
  - 1. Ductwork.
  - 2. Air Balance.
  - 3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

- A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.
- B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

- A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 – PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

- A. Perforated grilles shall not be used for supply air, return air or exhaust air.
- B. Stamped face, Egg Crate (of any material) or door grilles shall not be used.
- C. Acceptable Grilles and Diffusers:
  - 1. Supply Air Diffusers/Grilles
    - a. Lay-in Square Cone, Steel or Aluminum, 360° pattern
    - b. Lay-in Square Plaque, Steel or Aluminum, 360° pattern
    - c. Surface Mount Square Louver Face, Steel or Aluminum, 360° pattern
    - d. Round Cone, Steel or Aluminum, Steel or Aluminum, 360° pattern
    - e. T-Bar Slot, Steel or Aluminum
    - f. Double Deflection (Sidewall), Steel or Aluminum
  - 2. Return Air Grilles
    - a. Louvered face, Steel or Aluminum, 45° deflection, 3/4" blade spacing Surface or lay-in type

2.2 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger.
- C. Nailor Industries.

- D. Metalaire
- E. Price

## 2.3 ACCESSORIES

- A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct. Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.
- B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
  - 1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
  - 2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

### 3.2 INSTALLATION

- A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws.

END OF SECTION

SECTION 23 41 00

AIR FILTRATION

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air filters.

1.2 RELATED WORK

- A. Division 23 Mechanical.

1.3 SUBMITTALS

- A. Submit manufacturer's product data sheets and capacity information as specified.
- B. Submit recommended Dirty Filter pressure drop.

PART 2 – PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

- A. The filter cells:
  - 1. Pleated media.
  - 2. Disposable type.
  - 3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
  - 4. 18 pleats per linear foot of filter.
  - 5. 2" thick.
- B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
  - 1. Seal the media pack in a water resistant cardboard frame.
- C. Rated average dust spot efficiency of not less than 80%.
  - 1. Average synthetic arrestance in excess of 98% when tested in accordance with the ASHRAE 52-68 test standard.
- D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.
- E. Initial resistance to air flow:
  - 1. 500 fpm - 0.41" WG.
- F. UL listed with Class II rating.
- G. Air Filter Inc. Astro-Pleat MERV 13 minimum
- H. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.
- I. Standard sizes 16x20x2, 16x25x2, 20x20x2, 20x25x2 only. If 1" filters are only option for equipment, sizes must be standard sizes as listed.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install the filters in accordance with the manufacturer's instructions.

END OF SECTION

AIR FILTRATION  
23 41 00-1



SECTION 23 65 27

AIR-COOLED ROTARY SCROLL CHILLER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and Install a packaged, electric-driven, air-cooled, water chilling unit with multiple scroll compressors complete with controls.

1.2 RELATED WORK

- A. Division 23 - Mechanical
  - 1. Chilled Water Piping
  - 2. Insulation
  - 3. Building Management Control System
  - 4. Vibration Isolation
  - 5. Electrical Provisions of Mechanical Work

1.3 REFERENCES

- A. ANSI/ARI 550/590 - Water Chilling Packages using the Vapor Compression Cycle.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
- D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
- E. ANSI/NEMA MG 1 - Motors and Generators.
- F. ANSI/UL 465 - Central Cooling Air Conditioners.
- G. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have life of not less than 200,000 hours.
- H. ANSI/NFPA Standard 70 - National Electrical Code (NEC)
- I. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
- J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- K. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
- L. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments.

1.4 PERFORMANCE

- A. Provide performance as scheduled on drawings. Provide factory run test to ensure proper chiller operation. Provide certified documentation to Owner in Closeout Documents.

1.5 WARRANTY

- A. The Chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty for a period of five (5) years from substantial completion.
  - 1. The warranty shall include, but not be limited to the compressor assemblies including motor, condensers, fans, variable frequency drives, controls, evaporator, condenser, refrigeration system and all other auxiliary components and accessories as well as refrigerant and oils in systems.
  - 2. In the event of failure, provide new or factory authorized rebuilt parts. Shop or job site rebuilt parts are not acceptable.
  - 3. On all manufacturers warranties the chiller manufacturer shall provide a factory certificate listing as a minimum chiller model, serial, and warranty information as specified above. Each chiller tag shall be provided with an individual and unique warranty certificate. Manufacturer's representative warranty letters are not acceptable as an alternative to the original manufacturer's certificates.
  - 4. The chiller manufacturer authorized service agency is required to perform any and all warranty service. Contractor warranty service is not authorized. Warranty work shall be performed with District Representative present.

1.6 PREVENTATIVE MAINTENANCE SERVICE AGREEMENT

AIR-COOLED ROTARY SCROLL CHILLER



- A. Furnish service and maintenance agreement of chillers for a period of 5 years from date of substantial completion. Include quarterly system examinations, required adjustments, and control calibrations. Repair/replace parts in accordance with manufacturer's recommendations. All work performed by manufacturer technicians. Maintenance agreement shall include the following items as a minimum:
  - a. Analyze compressor fault log (quarterly)
  - b. Check IGV operation (quarterly)
  - c. Check controls settings for proper configuration (quarterly)
  - d. Verify transducers and sensors for accuracy (quarterly)
  - e. Analyze controls log and faults (quarterly)
  - f. Confirm correct water flow and pressure drop for evaporator (quarterly)
  - g. Evaluate the test/performance (quarterly)
  - h. Leak test entire unit (quarterly)
  - i. Check and record line voltage (quarterly)
  - j. Inspect power components for signs of overheating (quarterly)
  - k. Check and tighten all electrical components (annually)
  - l. Perform moisture prevention (annually)
  - m. Clean and leak test evaporator (annually)
  - n. Clean the evaporator flow sensor (annually)

#### 1.7 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.
- B. Submit the following information:
  - 1. Manufacturer's installation instructions.
  - 2. Minimum Circuit Ampacity.
  - 3. Maximum Overcurrent Protection size.
  - 4. Maximum conductor / Terminal Lug size.
  - 5. Minimum flow thru evaporator.
  - 6. Electrical interlocks.
  - 7. AHRI Chiller Efficiency values at 100%, 75%, 50% and 25%
- C. Submit recommended clearance dimensions for air flow and service.
- D. Submit coordination drawings as specified.
  - 1. Give consideration to adjacent structures as they affect air flow patterns.
- E. Submit internal wiring diagram of Control Center.
- F. Submit sequence of operation in narrative form.
- G. Submit a letter stating chiller being proposed meets the efficiency requirements of Centerpoint Energy's Score Program listed in Centerpoint Energy's Design Guide: HVAC Recommendations document.
- G. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

#### 1.8 STORAGE/HANDLING/SHIPPING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.
- C. Unit controls shall be capable of withstanding 203°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier

B. Daikin

C. Trane

## 2.2 COMPRESSORS

- A. Provide a minimum of two independently circuited hermetic rotary scroll type compressors with the following:
1. Direct drive, 3600 rpm, suction gas-cooled hermetic motor.
  2. Rubber isolation pads.
  3. Crankcase heaters.
  4. Oil sight glass.
  5. Load and unload solenoid valves.
  6. Discharge oil separator.
  7. Hot gas bypass for compressor unloading.
  8. Centrifugal oil pump.
  9. Oil charging valve.
- B. Provide capacity modulation from 100% to 25% via compressor cycling.
1. Control to be based upon leaving chilled water.
  2. To avoid excessive compressor cycling while maintaining leaving chilled water temperature at desired temperature +/- differential, compressor cycling set points to be separated by a minimum 20% capacity dead band.
- C. Ultra-Low Sound Compressor Control: Chiller manufacturer shall provide the following attenuation package and meet scheduled maximum A-weighted sound pressure level rating of 70dBA at 30' from the condenser coil side of chiller per AHRI. Complete sound attenuation package shall be provided regardless if scheduled dBA is met without.
1. Provide ultra-low sound blanket on a minimum of 100% coverage of each compressor, suction line, discharge line and oil separator.
  2. Removable Sound Covers shall be constructed with a Silicone-fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11 lbs./ft.3 density), and a Silicone-fiberglass cloth inner jacket. The covers shall be connected together by means of a cloth straps with "D" rings and Velcro fasteners. The inner and outer jackets shall protect against UV rays, oil and water. Finished Surface Mass – 3 lbs. per sq. ft., to cover compressors and extended components for the specified chiller. Stainless steel wire tie fastening assemblies are not acceptable.
  3. Provide detailed ultra-low sound acoustical data with submittal. Data shall include sound pressure rating across each octave band and A-weighted average for chiller as built with attenuation package.

## 2.3 CONDENSER COILS

- A. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannel layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Long Life Alloy Microchannel shall pass 4500hr salt spray rating uncoated.
- B. Protect all vertical or angled coil sections from hail or physical damage with corrosion resistant louvered hail guard including chiller ends, factory installed to cover compressor and condenser sections.
- C. Field adjustable head pressure based fan cycling controls for each circuit capable of maintaining minimum head pressure down to 20°F unless noted otherwise.
- D. Protect condenser coils during shipping.
- E. Provide condenser coils coated with corrosion resistant epoxy utilizing a dip and bake. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

## 2.4 FANS AND MOTORS

### AIR-COOLED ROTARY SCROLL CHILLER

- A. Direct Drive Ultra Low Sound propeller type fans.
  - 1. Vertical discharge with sound reduction without performance reduction.
  - 2. Protect fan blades with a heavy-gauge wire guard.
  - 3. Statically and dynamically balanced.
  - 4. Sound reduction engineered heavy-duty molded plastic blades designed to reduce airflow turbulence.
- B. Motors with built in thermal overload protection
  - 1. Permanently lubricated ball bearings.
  - 2. Weatherproof (TEAO or TEFC) motors.

## 2.5 COOLER/EVAPORATOR

- A. Provide brazed plate and frame direct expansion cooler with:
  - 1. Copper and stainless steel construction
  - 2. 150 psig water side working pressure
  - 3. ASME coded 430 psig refrigerant side working pressure
  - 4. Fully independent refrigerant circuit for each compressor.
  - 5. Serviceable construction including removable heads and field replaceable tubes.
  - 6. Drain and vent connection.
  - 7. Inline strainer on chiller inlet.
- B. Protect cooler with ambient controlled heater cable and minimum 1-1/4" thick flexible elastomeric rubber closed cell insulation. Heater cable to protect evaporator to -20°F (-29°C). Heater cable shall be wrapped helically around the shell under the insulation.
- C. Protect insulation and equipment from abrasion by unit enclosure.
- D. After completion of successful start-up, installing contractor shall seal all openings.
- E. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.
- F. Water connections shall be grooved or flanged.

## 2.6 CASING/ENCLOSURES

- A. House components in minimum 14 gauge galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.
- B. Unit panels, and control panels shall be 14 gauge, finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment of Federal Government Agencies.
- C. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide lockable disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.
- D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 672 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8"). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

## 2.7 REFRIGERANT CIRCUIT

- A. All units shall have a separate independent refrigerant circuit for each compressor. Twenty & 30 Ton

### AIR-COOLED ROTARY SCROLL CHILLER

single circuit; 40, 50 & 60 Tons, dual individual refrigerant circuits.

- B. Provide for each refrigerant circuit:
  - 1. Liquid line isolation valve.
  - 2. Filter dryer (replaceable core type).
  - 3. Liquid line sight glass and moisture indicator.
  - 4. Electronic or thermal expansion valve sized for maximum operating pressure. Expansion valves with less than five years of proven field operation are not acceptable.
  - 5. Charging valve.
  - 6. Discharge and oil line check valves.
  - 7. Compressor suction and discharge service valves.
  - 8. Relief valve.
  - 9. Full operating charge of refrigerant and oil.
  - 10. Unit factory leak tested at 200 psig.
  - 11. Provide refrigerant not schedule for phase out.

## 2.8 CONTROL PANEL

- A. The Control Center.
  - 1. NEMA 3R weatherproof cabinet with hinged lockable outer door.
  - 2. Control system.
  - 3. Solid-state compressor three phase motor protection.
  - 4. Single point field power connection points.
  - 5. Control interlock terminals.
  - 6. Fan motor and control circuit fuses.
  - 7. Individual contactors for each fan motor.
  - 8. Unit power terminal blocks for connection to remove disconnect switch.
  - 9. Power supply terminals for evaporator heater circuit.
  - 10. Dead front panels over line voltage.
  - 11. Control power / circuit transformer.
  - 12. Provide incoming power terminals, sized to accept the feeder conductors.
  - 13. Chiller run and alarm status relay cards.
- B. Microprocessor control system.
  - 1. Stage unit based on leaving water temperature control.
  - 2. Oil differential pressure setpoints.
  - 3. Motor protection.
  - 4. High pressure alarm.
  - 5. Loss of refrigerant alarm.
  - 6. Loss of water flow alarm.
  - 7. Freeze protection alarm.
  - 8. Low refrigerant pressure alarm.
  - 9. Auto start/stop switch.
  - 10. Chilled water setpoint adjustment.
  - 11. Anti-recycle timer.
  - 12. Compressor run status.
  - 13. Password protection.
  - 14. Low water temperature safety (freeze protection).
  - 15. Automatic pump down cycle.
  - 16. Limit supply water temperature pull down on start up to 1° per minute.
  - 17. Automatic lead-lag sequence change of compressors.
  - 18. Unload the compressors if the return water is too high.
  - 19. Compressor starts with the controlled cylinders unloaded.
  - 20. Reset of the chilled water temperature.
  - 21. Indicate status of safeties.
  - 22. Non-volatile memory (EPROM) with setpoints retained with battery backup.
  - 23. Automatic high pressure unloader to unload compressor at pressures above 375 psig.
  - 24. Auto restart after power failure.
  - 25. BacNET interface
  - 26. Alarm Relay
  - 27. Percent of Running Load Amperage

- C. Display the following information with 16 key keypad with two line x 40 character clear English Display for outdoor viewing.
  - 1. Supply and Return water temperature.
  - 2. Low water temperature cutout setting.
  - 3. Low ambient temperature cutout setting.
  - 4. Outdoor air temperature.
  - 5. English and Metric data.
  - 6. Suction pressure cutout setting.
  - 7. Each system suction pressure.
  - 8. Each system discharge pressure.
  - 9. Each system oil pressure.
  - 10. Percent of full load motor current.
  - 11. Liquid control range. (2.0 - 20°F above setpoint).
  - 12. Liquid pulldown rate sensitivity adjustment.
  - 13. Anti-recycle timer status for each compressor.
  - 12. Compressor starts & operating run hours.
  - 13. Safety shutdown shall be date and time stamped.
  - 14. Compressor run status.
  - 15. History and alarm diagnostic memory display.
- D. All control functions and information shall be available at the unit control panel or via RS 232 cable and phone modem to personal computer.
- E. Chiller shall include a relay board with dry contacts for alarms to notify a Building Automation System of certain events or states of the chiller.
- F. Chiller shall include input for leaving chilled water temperature setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.
- G. Chiller shall include input for chiller current limit setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Align chiller package on concrete footings as detailed on the drawings. 12" minimum height.
- C. Locate away from overhead restrictions. Maintain side clearances according to manufacturer's recommendations and maintain overhead clearance to allow full elimination of hot air discharge.
- D. Install units on vibration isolation pads.
- E. Arrange piping for easy dismantling to permit tube cleaning, removing and or repair.
- F. Level chiller.
- G. Install all electrical and control conduit into the bottom only of electrical cabinet. (No top or side cabinet penetrations)

#### 3.2 CHILLER MANUFACTURER START-UP/ FIELD SERVICES

- A. Provide the services of a factory trained service technician employed full time by the chiller manufacturer to start-up the system. Technicians, as required, shall be factory trained and experienced in the work they perform. (Contractor startup is unacceptable.)
- B. The technicians shall utilize comprehensive report forms to document results. Sample forms shall be submitted for review prior to commencing work.
- C. Upon completion of the work, the report forms shall be signed by the technicians and their supervisor and

included in the final report and Owner's manual.

- D. Submit four copies of the final report to the Architect/Engineer for approval within 10 working days of start-up.
- E. Follow the manufacturer's start-up procedures.
  - 1. Verify interlocks.
  - 2. Test and verify operation of safety controls.
  - 3. Calibrate controls.
  - 4. Verify microprocessor based control operation.
  - 5. Test, calibrate, and set the chilled water temperature controls.
  - 6. Verify chilled water temperature reset sequence.
  - 7. Verify operation of the integrated control panel.
- F. Measure and record the following data:
  - 1. Chilled water entering/leaving temperature.
  - 2. Chilled water flow through the chiller.
  - 3. Suction pressure/condensing pressure.
  - 4. Suction pressure/unloading steps.
  - 5. Air entering/leaving condenser; dry bulb temperature.
  - 6. Outdoor ambient; dry bulb.
  - 7. Motor nameplate voltage; phase and full load amperes.
  - 8. Heater coil in starter (as applicable)
    - a. Rating in amperes.
    - b. Manufacturer's recommendation.
  - 9. Power reading (voltage and amperes of legs at motor terminals).
- G. Test and calibrate the operation of the electronic ground current sensing devices.
- H. If the system has been shipped with a holding charge, provide the following:
  - 1. Leak test.
  - 2. Refrigerant pressure test.
  - 3. Evacuate, dehydrate and charge.
- I. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.
- J. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion.
- K. Do not operate the equipment for any reason until the factory start-up service has been completed and before all closed loop water treatment system is active.
- L. Provide a print-out from the unit micro-computer control system showing the correct operation of all system controls and components.
- M. Provide minimum 24 hour history log displaying accuracy of temperature control system in 15 minute intervals and documented number of compressor cycles during the 24 hour period.
- N. Remove construction screen from strainer at plate and frame heat exchanger, flush strainer, repair insulation at heat exchanger to like new condition and temporarily attach screen to chiller for inspection by owner and engineer.

END OF SECTION



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AIR HANDLING UNITS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air handling units with casing, fans, coils, filters and special items.

1.2 RELATED WORK

- A. Division 23 Mechanical
1. Air Balance
  2. Ductwork
  3. Controls
  4. Electrical Provisions of Mechanical Work
  5. Air Filtration
  6. Heating and Cooling Coils
  7. Other applicable sections

1.3 PERFORMANCE

- A. Unit capacities and characteristics as indicated.
1. Units must be certified in accordance with ARI Standard 430-66.
  2. UL 1995 certification for safety including electric heat.
  3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

- A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Submit fan performance curve for each unit:
1. Plot fan volume against static pressure, horsepower and efficiency.
  2. Show point of rating based on static requirements of the system.
  3. Chart of specific sound power level at each octave band center frequency.
  4. For variable volume units, plot fan volume over entire range.
- C. Submit for review a unit internal static pressure loss calculation.
1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
    - a. Coils
    - b. Dirty filters
    - c. Fan and unit system effect
    - d. Cabinet and cabinet inlet and outlet
    - e. Unit mounted dampers
  2. If a unit mounted outside air pretreatment section without supply fan, "piggyback" is specified:
    - a. Provide an itemized static pressure loss as indicated above.
    - b. Determine losses for unit configuration, i.e. parallel or series.
    - c. Include losses in the primary unit internal static pressure required by configuration.
  3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

AIR HANDLING UNITS

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1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.
- B. Manufacturer shall provide quick shipment options to minimize product lead times.

1.7 WARRANTY

- A. The Air Handling Unit manufacturer shall provide a full machine parts and labor warranty for a period of one (1) year from substantial completion.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier
- B. Daikin
- C. JCI
- D. Temtrol
- E. Thermal
- F. Trane

2.2 MISCELLANEOUS REQUIREMENTS

- A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
- D. Unit casing panels shall be double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections. Condensation on the exterior of the air handling units is not acceptable.
- E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).
- F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.
- G. Provide factory installed removable hinged access doors in the following locations:
  - 1. Entering and leaving side of all coils to allow for cleaning of coils on both sides of unit.
  - 2. Each side of filter compartment to allow changing of filters from either side.
  - 3. Each side of motor compartment to allow motor and isolation access.

4. Each side of condensate drain pan to allow for cleaning and inspection.
  5. Swing the doors against the casing static pressure.
- H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.
- I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.
- J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.

## 2.3 DRAW THROUGH AIR HANDLING UNITS

- A. Provided with:
1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
  2. Insulated sheet metal cabinet with removable panels for access to the interior.
  3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
1. Sized for 50% overload.
- C. Motors and Control:
1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
  2. Maximum operating point of 70 Hz.
  3. Minimum 90% nominal efficiency at loads of 70%-100%.
  4. Premium efficiency inverter duty
  5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
  6. +/- 10% voltage utilization range to protect against voltage variation.
  5. Cast iron frame and end plate
  6. Forged steel lifting eye
  7. Oversized conduit box with ground lug
  8. Provide with factory installed shaft grounding rings by Aegis
  9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
1. Single width, single inlet, backward curved welded aluminum plenum fan.
  2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
  3. Tested after being installed in the fan sections.
  4. Selected for the design air quantities and pressure of the system.
  5. Mounted on a common shaft if multiple wheels.
  6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
  7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be

extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.

- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
  - 1. Flame spread not higher than 25.
  - 2. Smoke developed rating not higher than 50.
- K. Filter section:
  - 1. Constructed with substantial hinges.
  - 2. Neoprene gasketing.
  - 3. Permanent quick release latching devices.
  - 4. Arranged to accommodate 2" thick filters as specified.
  - 5. Filter rack shall be factory manufactured to accommodate the filter sizes listed below. Filter racks shall not be altered in the field.
  - 6. Low velocity angled filter section unless otherwise specified.
  - 7. 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.
- L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- N. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- O. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

#### 2.4 BLOW THROUGH VARIABLE AIR VOLUME AIR HANDLING UNIT – DOUBLE DUCT

- A. Provided with:
  - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
  - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
  - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
  - 1. Sized for 50% overload.
- C. Motors and Control:
  - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
  - 2. Maximum operating point of 70 Hz.
  - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
  - 4. Premium efficiency inverter duty
  - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
  - 6. +/- 10% voltage utilization range to protect against voltage variation.
  - 5. Cast iron frame and end plate
  - 6. Forged steel lifting eye
  - 7. Oversized conduit box with ground lug

8. Provide with factory installed shaft grounding rings by Aegis
  9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
1. Single width, single inlet, backward curved welded aluminum plenum fan.
  2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
  3. Tested after being installed in the fan sections.
  4. Selected for the design air quantities and pressure of the system.
  5. Mounted on a common shaft if multiple wheels.
  6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
  7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.
- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Insulate the condensate drain pan with a minimum of 1-1/2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
  2. Smoke developed rating not higher than 50.
- J. Filter section:
1. Constructed with substantial hinges.
  2. Neoprene gasketing.
  3. Permanent quick release latching devices.
  4. Arranged to accommodate 2" thick filters as specified.
  5. Filter rack shall be factory manufactured to accommodate the filter sizes listed below. Filter racks shall not be altered in the field.
  6. Low velocity angled filter section unless otherwise specified.
  7. 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.
- K. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- L. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Provide a factory installed equalizing grid in the hot deck where heating coils are not installed.

- N. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.
- O. Design the entrance to the hot and cold decks and baffle to preclude wiping action of the air stream.
- P. Provide units with factory fabricated mixing box section that include an additional 2" thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- Q. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- R. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install air handling units according to manufacturer's instructions.
- B. Provide additional drive packages as required by the Testing and Balancing firm.
- C. Air leaks detectable by sound or touch are to be corrected.
- D. Air handling units are to be properly supported to prevent flexing, bending or distorting base rails.
- E. All coils and drain pans are to be cleaned prior to substantial completion if units are used during construction.
- F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
- G. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.
- H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
- I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.
- J. Align belts to eliminate wear and vibration of belts.
- K. Verify correct drainage of condensate from condensate pan.
- L. Verify correct rotation of fan and wiring of motor.
- M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.
- N. Replace filters as required if units are used during construction.

- O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.
- P. AHU motors must be wired with Kernay connections inside motor terminal boxes. No wire nuts. Kernay connections must be wrapped with rubber and electrical tape for insulation.

### 3.2 IDENTIFICATION

- A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
  - 1. Unit identification as indicated on Contract Drawings.
  - 2. Serial Number.
  - 3. Model Number.
  - 4. Capacity (CFM) and static pressure.
  - 5. Motor HP.
  - 6. Unit power supply: Volts / PH / Amps.
  - 7. Supply Fan Type.
  - 8. Coil GPM and pressure drop.
  - 9. Sales Order #.
  - 10. Date unit manufactured.

END OF SECTION



SECTION 23 82 16

HEATING AND COOLING COILS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

- A. Submit manufacturer's product data sheets and unit capacity information as specified.
- B. Submit manufacturer's Installation, Start-Up and Service Instructions.
- C. Submit internal wiring diagram.
  - 1. Electrical interlocks. \*

1.3 RELATED WORK

- A. Division 23 Mechanical.
  - 1. Air Handling Units.
  - 2. Fan Coil Units.
  - 3. Weatherproof Roof Mounted Air Handling Units.
  - 4. Ductwork.
  - 5. Terminal Boxes.

PART 2 – PRODUCTS

2.1 HOT WATER COILS

- A. Hot water coils:
  - 1. Constructed of copper tubes and aluminum fins.
  - 2. Designed and circuited for hot water.
    - a. Maximum temperature 200°F.
- B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations the maximum approved fin spacing is 8 fins per inch.
- C. Non-trapping circuit design:
  - 1. Working pressure 200 psi
  - 2. Tappings for drain and air vent
- D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
  - 1. Positioned to permit accurate pressure readings.
- E. Coils shall be constructed in casings as required for installation.
- F. Heating coils installed within ductwork or on the leaving side of a terminal unit shall be installed with a transition ductwork section to match the full face area of the heating coil. Provide an access door on both the entering and leaving sides of the duct mounted coil.

2.2 CHILLED WATER COILS

- A. Chilled water coils:
  - 1. Constructed of copper tubes and aluminum fins
  - 2. Designed and circuited for chilled water
  - 3. Minimum of six rows
- B. Non-trapping circuit design:
  - 1. Working pressure 200 psi.

HEATING AND COOLING COILS



2. Tappings for drain and air vent.

- C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.
- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.3 DIRECT EXPANSION COOLING COILS

- A. DX cooling coils:
  - 1. Constructed of copper tubes and aluminum fins.
  - 2. Designed and circuited for use with direct expansion refrigeration.
- B. Cooling coil face velocity:
  - 1. Not of magnitude to cause moisture to be carried off the coil.
  - 2. Maximum velocity as scheduled.
- C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.
- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.4 ELECTRIC HEATERS

- A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.
- B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.
- C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.
- D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.
- E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.
- F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.
- G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.
- H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when

the switch is on. Switch shall be unfused.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION



SECTION 23 82 18

DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall fan coil section with a wired wall mounted thermostat and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with inverter driven compressor, pre-charged with R410A or R32 refrigerant. air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

- A. Refrigerant Piping.
- B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.
- D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).
- E. A pressure charge of R410A or R32 refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.
- F. A dry air holding charge shall be provided in the indoor section.

1.5 WARRANTY

- A. Unit shall have a manufacturer's parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. Warranties shall start at the date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. Trane - Mitsubishi
- C. LG

DUCTLESS MINI SPLIT DX UNITS

## 2.2 INDOOR UNIT GENERAL

- A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.
- B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.
- C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

## 2.3 CABINET

- A. The casing shall have a smooth front, top return, in a white finish.
- B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
- C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

## 2.4 FAN

- A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.
- B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
- D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.
- E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

## 2.5 FILTER

- A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

## 2.6 COIL

- A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.
- B. Tubing shall have inner grooves for high efficiency heat exchange.
- C. All tube joints shall be brazed with PhosCopper or silver alloy.
- D. The coil shall be pressure tested at the factory.
- E. A sloped condensate pan and drain shall be provided under the coil. Drain connections shall be provided at each end of the drain pan.

### DUCTLESS MINI SPLIT DX UNITS

2.7 ELECTRICAL

- A. Power for the indoor unit shall be supplied from the outdoor unit.
- B. Power supply shall be as indicated on the drawings.
- C. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.
- D. The indoor unit shall not have any supplemental electrical heat elements.

2.8 CONTROL

- A. This system shall have a wired wall mounted thermostat/controller to perform input functions necessary to operate the system. The controller shall consist of a Power On / Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
- B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.
- C. There shall be a 24 hour On / Off timer.
- D. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the space controller, providing emergency operation and controlling the outdoor unit.
- E. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.
- F. The system shall be capable of automatic restart when power is restored after power interruption.
- G. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.9 OUTDOOR UNIT GENERAL

- A. The outdoor unit is designed specifically for use with the indoor units. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.
- B. When refrigerant lines are exposed on exterior of building provide "LINE-HIDE" line set cover system.
  - 1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
  - 2. Assembly Screws, stainless steel.

2.10 UNIT CABINET

- A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.
- B. Case and mounting feet shall be as follows:
  - 1. The base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.
- C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.11 FAN

- A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

DUCTLESS MINI SPLIT DX UNITS

- B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.
- C. The fan shall be provided with a raised guard to prevent contact with moving parts.
- D. The outdoor unit shall have horizontal discharge airflow.

#### 2.12 COMPRESSOR

- A. The compressor shall be a high performance, inverter driven rotary type.
- B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.
- C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

#### 2.13 OPERATION

- A. The outdoor unit shall have an accumulator.
- B. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.
- C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.
- D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

#### 2.14 ELECTRICAL

- A. Power supply shall be as indicated on the drawings.
- B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

#### 2.15 WALL AND ROOF BRACKET

- A. As indicated on the drawings, provide each unit 3 tons and below with a stainless steel mini-split condenser bracket.
- B. Unit shall be constructed for a maximum weight of 300 lbs.
- C. Unit shall be manufactured by Rectorseal model #WBB-300SS or Diveritech model #QSWB4000SS or approved equal.

#### 2.16 CONDENSATE PUMPS

- A. A condensate pump shall only be provided as a means of condensate disposal when a gravity drain is not available.
- B. Provide a Little Giant Model #554642 VCMA-20ULS-C-PRO-20.
- C. Unit shall be provided with anti-sweat sleeve, tank bracket and overflow detection switch.
- D. Condensate pump shall be wall mounted. Mount pump under wall cassette.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight indicating glass.
- B. Install units on vibration isolation pads.
- C. Ensure unit provided will meet the refrigerant and line lengths required by the installation as indicated on the drawings.
- D. Provide convenience water and electrical within 50 feet of new condensing unit.

3.2 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.
- B. The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 START-UP

- A. Follow the manufacturer's start-up procedures.
- B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring on suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION





SECTION 23 82 41

ELECTRIC DUCT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install electric duct heaters as indicated on drawings.

1.2 RELATED WORK

- A. Ductwork.
- B. Electrical Provisions of Mechanical Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Indeeco.
- B. Warren manufacturing Company, Inc.
- C. Redd-i, Inc.
- D. Reznor.
- E. Brasch.
- F. Chromalox.
- G. Markel.

2.2 MATERIALS

- A. Heater. Provide duct type electric heater. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.
- B. Casings. Heater casing shall be of the slip-in type for installation through a rectangular opening in the side of the duct.
- C. Bushings. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.
- D. Coil. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.
- E. UL Listing. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.
- F. Primary Protection. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.
- G. Secondary Protection. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.
- H. Feeder. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment.

ELECTRIC DUCT HEATERS

Field-installed conductors feeding the heater shall be sized for 125% of the connected load.

- I. Built-in Features. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Provide support rails in bottom of duct for duct heaters over 36" long. Install in accordance with manufacturer's recommendations. Before ordering duct heaters, coordinate with the structural drawings before locating the duct heater control boxes.

END OF SECTION

SECTION 26 01 05

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element
  - 2. Contractor information
  - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
  - 4. All parts and maintenance manuals for items of equipment
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates)
  - 9. Control operations / equipment wiring diagrams
  - 10. Coordination Drawings
  - 11. Schedule of Lamps, Light Engines
  - 12. Schedule of Ballasts and Drivers
  - 13. Schedule of Fuses
  - 14. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the completed manuals in final electronic form to the Architect / Engineer.
  - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
  - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Complete electronic manuals shall be delivered to the Owner prior to substantial completion.

PART 2 – PRODUCTS

2.1 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1"; Maximum ring size: 3".

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

### PART 3 – EXECUTION

#### 3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
  - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
  - 2. Format:
    - a. Size: 8-1/2" x 11"
    - b. Text: Manufacturer's printed data or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable
    - c. Identity of general subject matter covered in the manual.
  - 6. Binder as specified
- B. Content of Manual:
  - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement
    - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
  - 2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information.
  - 3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  - 4. Written text as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  - 5. Copy of each warranty, bond and service contract issued
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  - 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
  - 1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts:

#### ELECTRICAL OPERATING AND MAINTENANCE MANUALS

- 1) Function, normal operating characteristics, and limiting conditions.
    - 2) Performance curves, engineering data and tests.
    - 3) Complete nomenclature and commercial number of replaceable parts.
  - b. Operating procedures:
    - 1) Start up, break-in, routine / normal operating instructions
    - 2) Regulation, control, stopping, shut down and emergency instructions
    - 3) Summer and winter operating instructions
    - 4) Special operating instructions
  - c. Maintenance procedures:
    - 1) Routine operations
    - 2) Guide to trouble-shooting
    - 3) Disassembly, repair and reassembly
    - 4) Alignment, adjusting and checking
    - 5) Routine service based on operating hours
  - d. Servicing and lubrication schedule
    - 1) List of lubricants required
  - e. Manufacturer's printed operating and maintenance instructions.
  - f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
    - 1) Electrical
    - 2) Controls
    - 3) Communications
  - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - 1) Predicted life of part subject to wear
    - 2) Items recommended to be stocked as spare parts
  - h. Schedule of fuses
  - i. Complete equipment field accessible internal wiring diagrams
  - j. Schedule of lamps
  - k. Schedule of ballasts
  - l. Each Contractor's coordination drawings
  - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
  - n. Other data as required under pertinent sections of the specifications
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
  4. Provide complete information for products specified in Division 26.
  5. Provide certificates of compliance as specified in each related section.
  6. Provide start up reports as specified in each related section.
  7. Provide signed receipts for spare parts and material.
  8. Provide training report and certificates.

END OF SECTION



SECTION 26 05 00

ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.
- B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Electrical work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department adopted codes with amendments
  - 5. National Electrical Code with local amendments
  - 6. State Regulatory Agencies
  - 7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
  - 8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
  - 9. International Energy Conservation Code
  - 10. National Electrical Safety Code
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.

ELECTRICAL GENERAL PROVISIONS



- B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
1. Underwriters Laboratories, Inc. (UL)
  2. Factory Mutual Research Corp. (FMRC) (also referred to as "Factory Mutual Global," or "FM Global")
  3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
  4. Canadian Standards Association (CSA)
  5. A complete listing of acceptable NRTLs is published on the OSHA website at <http://www.osha.gov/dts/otpc/nrtl/>.
- C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer's Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.
- D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner's AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.
- E. Codes and Standards applicable to this Division:
1. ANSI – American National Standards Institute
    - a. ANSI Z535.1, Safety Colors
    - b. ANSI Z535.2, Environmental and Facility Safety Signs
    - c. ANSI Z535.3, Criteria for Safety Symbols
    - d. ANSI Z535.4, Product Safety Signs and Labels
  2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
    - a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings* [ANSI, IESNA]
  3. ASTM – American Society for Testing and Materials
  4. CBM – Certified Ballast Manufacturers
  5. ICC – International Code Council
    - a. International Building Code® (IBC)
    - b. International Existing Building Code® (IEBC)
  6. ICEA – Insulated Cable Engineers Association
    - a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
  7. IEEE® - Institute of Electronics and Electrical Engineers
    - a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
    - b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plants* ("Red Book")
    - c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* ("Green Book")
    - d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* ("Gray Book")
    - e. IEEE Std 242™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* ("Buff Book")
    - f. IEEE Std 315™, *Graphic Symbols for Electrical and Electronics Diagrams*
    - g. IEEE Std 399™, *Recommended Practice for Power Systems Analysis* ("Brown Book")
    - h. IEEE Std 446™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* ("Orange Book")
    - i. IEEE Std 493™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* ("Gold Book")
    - j. IEEE Std 519™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
    - k. IEEE Std 739™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* ("Bronze Book")
    - l. IEEE Std 902™, *Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems* ("Yellow Book")
    - m. IEEE Std 1015™, *Recommended Practice Applying Low-Voltage Circuit*



- b. NFPA 70™, *National Electrical Code® (NEC®)*
  - c. NFPA 70E, *Standard for Electrical Safety in the Workplace.*
  - d. NFPA 101®, *Life Safety Code®*
  - e. NFPA 110, *Standard for Emergency and Standby Power Systems*
  - f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
  - g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
  - h. All other NFPA codes and standards except NFPA 5000
- 13. OSHA – Occupational Safety and Health Administration
  - 14. IECC – International Energy Conservation Code
  - 15. ISO – International Organization for Standardization
  - 16. State and Local Energy Conservation Code
  - 17. Applicable County and Municipal Codes

#### 1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.
- C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.
- D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.
- E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.

1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
  2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
  3. Three sets of blue-line prints of each contract as-built drawing.
  4. Three sets of pdf prints of each contract as-built drawing on CD.
- C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
  2. Remove Engineer's Seal, name, address, and logo from drawings.
  3. Mark documents RECORD DRAWINGS.
  4. Clearly indicate: DOCUMENT PRODUCED BY:
  5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
  6. Indicate exact location of all underground electrical raceways, and elevations.
  7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
  10. Exact location of all electrical equipment in and outside of the building.
  11. Exact location of all outdoor lighting poles and equipment.
  12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
  13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  14. Cloud all changes.
  15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.
- 1.7 SPACE REQUIREMENTS
- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.
- 1.8 RELATION WITH OTHER TRADES
- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
  2. The responsibility for alignment of motor and driven equipment is specified in the related division.

- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

#### 1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

#### 1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

#### 1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

#### 1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

#### 1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

#### 1.14 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
  - 1. Obtained from utility maps and other substantially reliable sources.
  - 2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

#### 1.15 OPERATING TESTS

- A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required

### ELECTRICAL GENERAL PROVISIONS

to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

- A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.
- B. Manufacturer's warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.
- C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

- A. General: Refer to Division 1 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 – EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

- A. Identification of Equipment:
  - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
  - 2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
    - a. Utility Power: White letters on black background

Generator Power (White letters on red background)

UPS Power: White letters on blue background

Load Bank Circuits: White letters on green background

Solar or Wind Power Generation: White on orange background

- b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "PANEL HA –fed from MDP-6 located in Mech. Rm. 100"). The words "fed from" and "located" shall be included in the labeling.

Example: Panel HA  
Fed From MSB  
Located Main Elec. RM 100

Example: Disconnect for Panel LK  
Location: Kitchen  
Fed From Transformer TLK  
Located Main Elec. RM 100

- c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in 1/4-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
- d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel "HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100")
- e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
- f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1 West Parking Lot Pole Lights Fed From Panel HA-2,4,6 Located Main Elec. Rm. 100 Control Circuit-Panel LA 42 Located Main Elec. Rm. 100 Controlled-BMCS	Receptacle Contactor C2 Table Recpts Lab Rm 100 Fed From Panel LA-2,4,6,8 Located Mech. Rm. 110 Control Circuit-Panel LA-42 Controlled-Emer Shut Off Mushroom Switch Rm 101
GTD Example	
Exterior lighting wall packs / north soffit / west metal canopy Fed from Panels EHA-2 located in Elec. RM 105 and HA-1 via Lighting Contactor controlled by BMCS located in Elec. RM 200.	

- g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A
- h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.
- i. Panel names for 277/480v shall start with the letter "H" and 120/208v, 120/240v shall start with the letter "L". No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner's electrical representative. Panel names shall not include the letter "I". Transformer names shall start with the letter "T" followed by the panel name it serves, i.e. TLA.

- j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.

Main Service ATS Example Wall Mounted Lighting ATS Example

ATS-1	ATS
Emer Power-Emer Generator	Exterior Wall Packs/Soffit Lights
Located Chiller Yard	North/West Metal Canopy Lights
Normal Power-MSB	Fed from EHA-2
Located-Mech Rm 100	Located Mech Rm 200
Serves Panel EHA	Fed From HB-4
Located-Mech Rm 100	Located Mech Rm 150

- k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.
- l. Switchgear, switchboards, panelboards, motor control centers, or service equipment available fault current labeling: Provide a 2x3 inch permanently affixed (notice) label with white lettering on contrasting blue background permanently affixed to the equipment prior to energizing the equipment. The label shall include the date of installation and the date of calculation and comply with ANSI Z535.4 current standards design and durability. The date of calculation shall be the date indicated by the Engineer of Record's seal on the Construction Documents.  
Example:

AVAILABLE FAULT CURRENT: ##, ### AMPS  
DATE OF INSTALLATION: MM/DD/YY  
DATE OF CALCULATION: MM/DD/YY

3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as "corridors". Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect's final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner's motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.
- B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information

ELECTRICAL GENERAL PROVISIONS



at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

- D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.
- E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.
- F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.
- G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼" high white letters on ½" tall black background for digital lighting modules as "DLM". Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay location. Modules or relays located in mechanical or electrical rooms or other areas other than above ceiling: Adhere label to the cover of the module or relay and identify the area they control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting control switches or push button stations located remotely from the area they control: Adhere label to device face plate, not obstructing screw fasteners, and intuitively identify function such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.

### 3.2 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

### 3.3 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
  - 1. Provide the training during regular working day.
  - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
  - 3. Refer to other specification sections for additional training and commissioning requirements.
- B. Time to be allocated for instructions.
  - 1. Minimum of 20 hours dedicated instructor time
  - 2. 4 hours on each of 5 days
  - 3. Additional instruction time for specific systems as specified in other Sections.
- C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
  - 1. One copy to the Owner
  - 2. One copy to the Architect / Engineer
- D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).

- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

#### 3.4 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

#### 3.5 HOUSEKEEPING PADS

- A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.
- B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.
- C. Concrete pads:
  - 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
  - 5. 6-inch x 6-inch #8 wire reinforcement mesh.

#### 3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

#### 3.7 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

### 3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

### 3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

- A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
  - 1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
  - 2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
  - 3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer's minimum circuit conductors, at no additional cost to the Owner.
  - 4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
  - 5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer's maximum recommendations.

### 3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE COORDINATION

- A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer's recommendations for all adjustable overcurrent devices specified or provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.
- B. Contractor shall adjust all overcurrent device settings based on manufacturer's recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.
- C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.
  - 1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.
- D. Information to be determined and applied to electrical equipment:
  - 1. Arc-Flash Protection Boundary

2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841<sup>TM</sup>
3. Working distance calculated in accordance with IEEE Std 1584a<sup>TM</sup>
4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
  - a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
5. System phase-to-phase voltage
6. Condition(s) when a shock hazard exists (e.g. "With cover off")
7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
10. Unique equipment designation or code (described under "Component Identification")
11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
13. Date that the hazard analysis was performed.
14. "Served from" circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
15. If applicable, the "serves" circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a<sup>TM</sup>, paragraph 9.2.3.
17. Use a "DANGER" label where the calculated arc-flash incident energy exceeds 40 cal/cm.

- E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

### 3.11 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
  2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

### 3.12 TESTING

- A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.
- B. The project will not be declared substantially complete until the following has taken place.
1. The "As-Built" drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner's Construction Representative.
  2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
    - a. Occupancy Sensor and Lighting Controls
    - b. Surge protective device equipment
    - c. Overcurrent devices
    - d. Motor Controllers
    - e. Emergency Lighting
    - f. Building Fire Alarm System

### 3.13 LOAD BALANCING

- A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, "Motor Tip

2024 Cy-Creek HS Renovations  
Cypress-Fairbanks ISD  
Houston, Texas

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END OF SECTION

SECTION 26 05 05

ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.
- D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.
- E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

ELECTRICAL ALTERATIONS PROJECT PROCEDURES

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
- B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminaire that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures.
- C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Panelboards Reused and Modified for Renovation: 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.

### 3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. 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.
- C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.
- D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.
- E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
  - 1. Remove exposed conduit that has been abandoned.
  - 2. Cap conduit beyond the finish line.
  - 3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.
- F. Where new/existing luminaries or devices are shown being connected to existing circuits:
  - 1. Field verify existing system voltage
  - 2. Provide ballast / device to match system voltage

- G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.
- H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.
- I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- N. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- O. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- P. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- Q. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- 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's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. 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 approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

1. Remove abandoned electrical distribution equipment, utilization equipment, outlets and accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, communications closet, or cabinet. Abandoned wiring and raceways can result from actions that include the following:
    - a. Equipment is removed or relocated
    - b. Fixtures are removed or relocated
    - c. System is no longer used
    - d. There is no demonstrable near term future use for the existing circuit or raceway system.
  2. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:
    - a. The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
    - b. Removal is not feasible due to hazards, construction methods, or restricted access.
    - c. Removal of abandoned conductors may damage conductors that must remain operational.
  3. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed.
  4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
  5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
  6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.
- B. All items 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 them 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 and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative 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's representative, at no additional cost to the Owner.
- D. Conduit 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's representative. Conduit 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 Construction Inspector. 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 that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.

- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- K. Existing conduit raceway found to need additional hangers installed and/or junction box covers shall be added at no additional cost to the Owner.
- L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

### 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description "existing". Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

### 3.7 CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:
  - 1. Notify the Owner immediately of any disruption or damage to any low voltage system.
  - 2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
  - 3. For each low voltage system a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
  - 4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION



SECTION 26 05 10

CONTRACT QUALITY CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide manufacturer's qualified personnel to observe:
  - 1. Field conditions
  - 2. Condition of installation
  - 3. Quality of workmanship
  - 4. Start-up of equipment
  - 5. Testing, adjusting, and balancing of equipment
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCKUPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and

CONTRACT QUALITY CONTROL

support devices, seals and finishes.

- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

#### 1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
  - 1. Rough-in
  - 2. Finish with all appurtenances in place
  - 3. Demonstrations
- B. Refer to other specification sections for pre-functional checklist for requirements to aid in preparing mock-ups.

### PART 2 – PRODUCTS

#### 2.1 EQUIPMENT AND MATERIAL

- A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

### PART 3 – EXECUTION

#### 3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.
- B. Coordination Drawings:
  - 1. Electrical room size and location required and to scale
  - 2. Equipment and accessories, switchgear and piping
  - 3. Indicate clearances and service access.

#### 3.2 ELECTRICAL ACCEPTANCE TESTING

- A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification* (ATS).
- B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
  - 1. Installed in accordance with design documents and manufacturer's instructions.
  - 2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).
  - 3. Ready to be energized.
  - 4. Operational within industry and manufacturer's tolerances.

#### 3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

- A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

#### 3.4 MOCK-UPS

- A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.

- B. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, all lighting controls, covers plates, rough-in boxes, conduits, MC cables, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit or MC Cable routing and conductor fill.
- C. Mock up a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.
- D. Mock up ten feet of cable tray including all supports, hardware and bonding.

END OF SECTION



SECTION 26 05 12

ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 01 and as outlined below.
- B. Provide individual submittals based on the project specification section number and description and only items specified or required in that specific project specification section.
- C. Submit product data shop drawings only for the following items indicated below when included as part of the project specifications, and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review, typically for basic materials and commodity off-the-shelf materials, and/or to imply that materials shall be provided as specified without exception.
- D. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- E. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, in the related O&M manual section.

1.2 ARCHITECT / ENGINEER REVIEW OF SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review requested submittals with reasonable promptness. Specific equipment submittal within a materials specification section that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
  - 2. Affix stamp and initials or signature and indicate requirements for resubmittal or exceptions to submittal as submitted.
  - 3. Return submittals to Contractor for distribution or for resubmission.
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes, or coordination with the work of other trades.
- D. The review of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

- A. Do not make requests for product or material substitution employing the procedures of this Section. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 – PRODUCTS

- A. Each individual submittal shall be an individual specific electronic data file with the file name resembling the product specification section number and title. Refer to Division 01 for additional data file format and media requirements.

ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA



## PART 3 – EXECUTION

### 3.1 SPECIFICATION COMPLIANCE REVIEW

- A. Do not submit an outline form of compliance, submit a complete copy with the product data.
- B. Mark up a complete copy of the complete specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:).
- C. Variances for product or materials typically include updated model numbers or updated versions of the specified product from the same manufacture or an equal or better product from the approved manufactures list. Substitutions from manufacture's not on the approved manufacture's will not be reviewed unless prior approval using one of the procedures for substitutions or changes in the contract documents are followed as required in Division 01.

### 3.2 COMPOSITE COORDINATION DRAWINGS

- A. Produce a set of composite coordination drawings for above ceiling, below ceiling, and below floor of electrical, mechanical, and technology equipment rooms and equipment yards for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of items including but not limited to structural and architectural elements, all mechanical and plumbing piping, ductwork, equipment, electrical conduit, low voltage communications and safety/security systems cabling, cable trays, lighting, electrical switchgear, generators and UPSs, and any public or private building utility services.
  - 1. Prepare the composite plans at one-quarter inch (1/4") equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
  - 2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
  - 3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
  - 4. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- B. Submit composite coordination shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.
  - 1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
  - 2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
  - 3. Submit coordination and shop drawings prior to rough-in and fabrication.

### 3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal. Do not submit entire product catalogs, submit only specific data sheets indicating required product information and available product options or accessories.
- B. Submittal Specification Information:
  - 1. Every submittal document shall bear the following information as used in the project manual:
    - a. The related specification section number
    - b. The exact specification section title
    - c. Additional identifiers as required in Division 01.
  - 2. Submittals delivered to the Architect / Engineer without the specified information will not

#### ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

be processed. The Contractor shall bear the risk of all delays, as if no submittal had been submitted or delivered.

- C. All product options specified shall be clearly indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as either part of or not part of the product data submitted shall become part of the Contract and shall be assumed to be provided with the product submitted.
- D. Mark each copy of standard manufacture's printed data to identify pertinent products, referenced to specification section and article number.
- E. Show reference standards, performance characteristics and capacities; wiring diagrams and controls; component parts; finishes; dimensions and required clearances.
- F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete or strike through information not applicable.
- G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as necessary for reference.
- I. Identify field dimensions; show relation to adjacent or critical features or work or products.
- J. Submit individually bound shop drawings and product data for the following when specified or provided.
- K. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other electrical switchgear dependent on the results of the study for specific product selection by the vendor or contractor for compliance with the study.
  - 1. The emergency life safety power system equipment shall be fully coordinated as required by the NEC.
  - 2. The AIC and WCR ratings of all products meet or exceed the available fault current at that equipment's location.
  - 3. Electrical systems other than life safety power systems shall be coordinated as much as practicable while reducing arc flash energy as much as practical.
- L. Required submittals when products are indicated or specified:
  - 1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis three (3) weeks prior to any overcurrent device submittal to allow modifications to overcurrent device product selection submittal based on the manufacture's analysis and recommendations at no additional cost to the Owner.
  - 2. Enclosed Switches and Circuit Breakers
  - 3. Enclosed Motor Controllers
  - 4. Panelboards, load centers, and enclosures
  - 5. Wiring devices
  - 6. Lighting fixtures
  - 7. Lighting Controls and Occupancy Sensors
  - 8. Surge Protection Devices
  - 9. Site Lighting Poles, Fixtures, Drivers, and Lamps
  - 10. Electrical controls and time switches
  - 11. Electrical Contactors
  - 12. Motor control centers
  - 13. Transformers
  - 14. Switchboards
  - 15. Metering equipment for energy monitoring and usage
  - 16. Emergency/Standby generator sets and transfer switches
  - 17. Surface Raceways
  - 18. Architectural Dimming Systems

ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- 19. Theatrical Lighting Systems
- 20. Sports Lighting Equipment, Fixtures, Poles

### 3.4 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

### 3.5 CONTRACTOR RESPONSIBILITIES

- A. Review, make corrections or annotations for clarification of manufacturer supplied data, stamp and sign submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with the Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are required, until such submittals have been produced and bear contractor's stamp of acceptance or approval. Do not fabricate products or begin work until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors, omissions, or un-approved substitutions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service; manufacture's and code required clearances.
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.
- J. General and Electrical Contractor's Stamp of Approval
  - 1. The general contractor and the electrical contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
  - 2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
  - 3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
  - 4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

### 3.6 SUBMISSION REQUIREMENTS

#### ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in, foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.
- B. Number of submittals required:
  - 1. Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions or coordination drawings.
  - 2. Product Data: Submit electronic data PDF files. Refer to Division 01 for specific requirements. PDF files that are 20MB or larger may indicate that a submittal includes information not specifically relevant to the specific product being provided, information not required for the review of the specific product such as a complete product catalog or catalog section. Contractor shall include only the product data required to review the specific products characteristics for compliance with the contract documents.
- C. Accompany submittals with transmittal letter containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and contact information.
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data as required in Division 01.
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval.
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
  - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items requiring correlation for efficient function or for installation

### 3.7 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
  - 1. Indicate that the document or sample is a resubmittal
  - 2. Identify changes made since previous submittals
- B. Indicate any additional changes which have been made by the contractor other than those requested by the Architect / Engineer.

END OF SECTION



SECTION 26 05 19

CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide electrical conductors, wire and connector work as shown and specified manufactured in the USA.
- B. Types: The types of conductors and connectors required for the project include the following:
  - 1. 600V building conductors
  - 2. 600V building conductor connectors
  - 3. 600V 2-hour fire rated power cable
- C. Application: The applications for conductors and connectors required on the project are as follows:
  - 1. Power distribution circuitry
  - 2. Lighting branch circuitry
  - 3. Appliance, receptacle, and equipment branch circuitry
  - 4. Motor branch circuitry
  - 5. Control wiring
  - 6. Line voltage
- D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

- A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

- A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – Provide products manufactured in the USA

2.1 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
  - 1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
  - 2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.

CONDUCTORS AND CONNECTORS – 600 VOLT

- C. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
1. All wiring inside lighting fixtures shall be temperature rated per NEC.
  2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.
- D. Insulation for 2-hour fire rated power cables: Insulation shall meet or exceed the requirements of UL 2196 Fire Test for Electrical Circuit Protection Systems, and UL 44, Standards for Fire Resistive Cable. Conductor ampacity shall be based on 75C. Combination UL Type insulation types are permissible where the required UL Type is part of the combination UL listing.
1. Conductors installed underground: Insulation for underground fire rated conductors shall be wet location, UL Type RHW 75 degrees C, or UL RHW-2 90 degrees C.
  2. Conductors installed above ground: Insulation for above ground fire rated conductors shall be UL Type RHH 90C or RHW 75C or UL RHW-2 90C.
  3. Electrical Circuit Protective Systems (FHIT) – System 27 of the UL Fire Resistance Directory
- E. Cable Lubricant: Fire resistant, nonflammable, water-based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.

## 2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

- A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR-CODED INSULATION THROUGHOUT					
System/Phase	A	B	C	N	G	IG
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:

1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.

## CONDUCTORS AND CONNECTORS – 600 VOLT

- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.
- C. Conductors:
1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
  2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
  3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
  4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
  5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
  6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
  7. Run feeders their entire length in continuous section without joints or splices.
  8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
  9. Provide the same size wire from the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
  10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
    - a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    - b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.
    - c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    - d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
    - e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
    - f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
  11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that

CONDUCTORS AND CONNECTORS – 600 VOLT



are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.

12. Support conductors in vertical raceways, as required by the NEC.
13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
21. Clean conductor surfaces before installing lugs and connectors.
22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
24. Run mains and feeders their entire length in continuous pieces without splices or joints.
25. Color code conductors.
26. Do not install a pull string in conduits containing conductors.
27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.

D. Two-hour fire rated cable:

1. Two-hour fire rated power cable shall be installed per manufacturer's installation instructions in compliance with UL Fire Resistance Directory, Electrical Circuit Protective Systems (FHIT), and System 27.
2. Two-hour fire rated power cable shall be installed in rigid steel EMT or rigid steel galvanized conduit (RGC) with steel fittings. Provide fire rated sealant to the end of the raceway to prevent gases from migrating from the fire rated cable into the equipment.
3. Provide two-hour rated cable where conduit or cables enters or passes through the building envelope at areas or rooms that are not two-hour rated equipment rooms for the following:
  - a. Fire Pump feeders.
  - b. Emergency Feeders (Life Safety) as defined by NFPA Article 700.
  - c. Legally required level one standby systems as defined by NFPA 110 and NFPA Article 701. These systems include but are not limited to those used to aid firefighting and rescue operations, smoke removal systems, and elevators designated for ADA and/or fire rescue operations.
4. Alternate two hour rated feeder conductor sizes may be substituted for the

CONDUCTORS AND CONNECTORS – 600 VOLT

required conductor ampacity, voltage drop, or equipment lug terminations based on two-hour fire rated conductor standard size availability or provided equipment manufacturer's cable terminations. The substituted conductor ampacity shall meet or exceed the specified cable ampacity and exceed the required equipment minimum circuit ampacity. Provide substitutions and the required conduit sets and sizes as required for the substitutions at no additional cost to the Owner.

- E. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- F. Splices and Joints:
  - 1. In accordance with UL 486A, C, D, E, and NEC.
  - 2. Aboveground Circuits (No. 10 AWG and smaller):
    - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors. Push-in type connectors are prohibited.
    - b. The integral insulator shall have a skirt to completely cover the stripped wires.
    - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
  - 3. Motor connections:
    - a. All AHU motors connections shall be split bolt connectors.
    - b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
    - c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.
- G. Aboveground Circuits (No. 8 AWG and larger):
  - 1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
  - 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
  - 3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
  - 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- H. Underground Branch Circuits and Feeders:
  - 1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.

### 3.2 TESTING

- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.
- B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.
  - 1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

### CONDUCTORS AND CONNECTORS – 600 VOLT

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.
- C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.
- D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

CONDUCTORS AND CONNECTORS – 600 VOLT

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT  
(Specification Paragraph 3.2, C)

Date\_\_\_\_\_

Contract and Work Location: \_\_\_\_\_  
Contract (Project) No.: \_\_\_\_\_  
Circuit Identification: \_\_\_\_\_  
(Dwg., Title, Number and Ckt. Number)

Test Equipment: \_\_\_\_\_  
(Make, Model, Serial No., Etc.)  
Applied Test Voltage \_\_\_\_\_  
Normal Oper. Voltage \_\_\_\_\_  
Cable Installation: New \_\_\_\_\_ Used \_\_\_\_\_  
(Date) \_\_\_\_\_ (No. Years)  
Cable Size \_\_\_\_\_AWG  
Cable Length \_\_\_\_\_Ft.  
Cable Material \_\_\_\_\_Cu \_\_\_\_\_Al  
Temperature \_\_\_\_\_ Humidity \_\_\_\_\_

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION



SECTION 26 05 26

ELECTRICAL GROUNDING

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
  - 1. National Electrical Code.
  - 2. Governing local codes.
  - 3. All Local Utility Companies
- B. Ground effectively and permanently.
  - 1. Neutral conductor at the main service disconnect and other separately derived systems.
  - 2. All conduit systems.
  - 3. All electrical equipment and related current carrying supports or structures.
  - 4. All metal piping systems.
  - 5. All building structural metal frames.
  - 6. All telephone/voice/video/CATV/data utilities

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. nVent ERICO
- C. Burndy
- D. O. Z Gedney
- E. Eaton

2.2 GROUNDING ELECTRODES

- A. Driven Rod Electrode
  - 1. 3/4" x 10'-0" copper clad grounding electrode.
  - 2. UL listed.
  - 3. Approved thermal fusion connector methods (exothermic).
- B. Metal frame of building or enclosure.
- C. Foundation concrete encased rebar.

ELECTRICAL GROUNDING

2.3 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

- A. MDF closets/head end rooms: Erico Cadweld #B544A028 ground bar with 7/16-inch holes.
- B. IDF closets, Erico Cadweld #B542A004 ground bar with 7/16-inch holes.
- C. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

- A. Exothermic type for underground and structural steel; Cadweld
- B. Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.5 WIRE

- A. Stranded, copper cable
- B. Foundation Electrodes: 4/0 AWG
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

PART 3 – EXECUTION

3.1 GROUNDING AND BONDING

- A. In the service equipment, provide a separate (dedicated) ground bus.
  - 1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
  - 2. Resistance of neutral to ground shall not exceed 10 Ohms.
  - 3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground .ring.
  - 4. Provide grounding and bonding at the power company's metering equipment.
  - 5. Provide access and cover for access to the ground grid and removable connections for testing the system.
- B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
  - 1. In rigid PVC conduit.
  - 2. Provide thermo fusion connection for each rod ground electrode.
    - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
    - b. Install rod electrodes as required. Install additional rod electrodes as required to achieve specified resistance to ground.
    - c. The minimum distance between driven ground rod electrodes shall be 10'.
  - 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and 25 Ohms for equipment grounds.
    - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
- C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.
- D. Provide an insulated isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and isolated grounding receptacles.
- E. Provide all conduit terminating in switchgear, transformers, switchboards, panelboards and

ELECTRICAL GROUNDING

voice/data outlets with grounding bushings, where required, and ground wire extended to ground bus in equipment. Install grounding bushings where reducing washers are used and concentric and eccentric knock-outs are used.

- F. Main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- G. Provide bonding to meet Regulatory Requirements.
- H. Interface with lightning protection system when lightning protection system is specified.
- I. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- K. Do not use spring steel clips and clamps.
- L. Do not use powder-actuated anchors.
- M. Do not drill or cut structural members.
- N. Do not use compression or mechanical connectors underground.
- O. Do not use sheetmetal or self-drilling screws for bonding connections. Provide listed or approved connectors.
- P. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
  - 1. Access well top shall be flush with finish paved surfaces.
  - 2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
  - 3. Provide thermal fusion (exothermic) connectors approved for direct burial.

### 3.2 METAL FRAME OF BUILDING OR STRUCTURE

- A. Effectively ground the building steel or structure per NEC 250-52 (2).

### 3.3 UFER GROUND

- A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

### 3.4 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, and other non-electrically continuous raceway fittings.
- B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
- C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
- D. Exterior Electrical Equipment Racks:
  - 1. Provide driven ground electrode.



- E. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Grounding shall conform to ANSI/TIA/EIA 607(A) – Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum. Bonding shall be of low impedance to assure electrical continuity between bonded elements.
1. MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico #EGBA14424MM ground bar, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the nearest electrical switchboard or panelboard.
  2. IDF Closets Telecommunications Ground Bar (TGB): Provide Erico #EGBA14410FF ground bar mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel and to ground bus of nearest electrical panelboard or switchboard.
  3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
  4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
  5. Bond each equipment rack, cabinets, frames, together and with #6 AWG insulated ground conductor to the local TMGB / TGB. Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.
  6. Route TMGB – TGB ground conductor using the shortest, straightest, route practical with long radius curves.
  7. All conduits terminating to cable trays, wireways, and racks shall be mechanically fastened. When connected to a cable tray or rack, it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF room grounding bar using #6 AWG copper.
- F. Ground lighting fixture bodies to the conduit grounding system.
- G. Bond receptacle ground to the box and conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.
- H. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).
- I. Provide OZ Type "BJ" bonding jumper at all expansion joints, points of electrical discontinuity or connections in conduit where firm mechanical bond is not possible, such as flexible connections, insulating couplings, etc.
- J. Ground each lighting and power panelboard by connecting the grounding conductors to the grounding stud.
- K. Ground each secondary dry-type transformer to the ground bus of the primary side panelboard. Provide a bonding jumper between the ground stud and the neutral. Ground transformer ground stud to ground ring if a ground ring is installed or the nearest structural steel member.
- L. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes, but is not limited to, switchboards, panelboards, disconnect switches, receptacles, cable trays, controls, fans, air handling units, pumps and flexible duct connections.
- M. Ground each light pole, power distribution poles, and metal conduit stub-ups at each light pole base.
- N. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.
- O. Bond hot water and cold water piping together at each domestic water heater.

### 3.5 MANHOLE AND/OR PULL BOX GROUNDING

- A. Provide a driven ground rod and ground bond ring in each power and telephone manhole or pull

box. Bond cable racks and medium voltage cable shields at splices and terminations, ductbank conduit ground bushings and all other metal components in manholes or pull box to the ground ring.

3.6 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.7 TESTING

- A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
  - 1. Inspect and test in accordance with NETA ATS except Section 4
  - 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13
- B. True Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.
- C. Two-Point Bonding Measurements: The Two-point Bonding test should be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 Ohms (100 milliohms).
- D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION



SECTION 26 05 27

EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
  - 1. National Electrical Code
  - 2. Governing local codes
  - 3. Local Utility Company
- B. Ground effectively and permanently.
  - 1. Verify existing neutral conductor bonding at the main service disconnect and at other new/relocated or reused separately derived systems.
  - 2. All new/relocated conduit or cable tray systems and busway
  - 3. All new/relocated electrical equipment and related current carrying supports or structures
  - 4. All new / relocated metal piping systems
  - 5. All new building structural metal frames

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. nVent ERICO
- C. Burndy
- D. O.Z. Gedney
- E. Eaton

2.2 GROUNDING ELECTRODES

- A. Driven Rod Electrode
  - 1. 3/4" x 10'-0" copper clad grounding electrode, UL listed
  - 2. UL listed grounding electrode connector
  - 3. Approved thermal fusion methods (exothermic)
- B. Metal Frame of Building
- C. Existing grounding electrode system

EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

## 2.3 DRIVEN ELECTRODE ACCESS BOX AND COVER

- A. Hubbell Tier 22 FRP 20-inch round bolt down cover with "GROUND" embossed on top.

## 2.4 MATERIALS AND COMPONENTS

- A. Reference other sections of this specifications for materials specified there.
- B. Heavy-duty, copper, two bolt type, copper alloy or bronze compression lugs for grounding and bonding applications, in configurations required for particular installation.

## PART 3 – EXECUTION

### 3.1 SYSTEMS 600 VOLTS OR LESS

- A. In the existing service equipment, field verify existing condition of ground bus.
  - 1. Field verify existing bond of the ground bus to the existing service grounding conductor, to the neutral bar.
  - 2. Tighten existing ground lugs and connections.
- B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
  - 1. In rigid PVC conduit.
  - 2. Provide thermo fusion connection for each rod ground electrode.
    - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
    - b. Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
    - c. The minimum distance between driven ground rod electrodes shall be 10'.
  - 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and for equipment grounds.
    - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
    - b. Refer to drawings for project specific ground resistance requirements.
- C. Field verify the grounding electrode conductor between the ground bus and the grounding electrode systems are in compliance with the NEC.
- D. Provide an insulated grounding conductor inside all new conduits, raceways, surface raceways and cables used for power distribution. The ground wire shall be bonded to each box. All bonding jumpers shall be routed inside conduit or raceway.
- E. Provide an insulated, isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and receptacles.
- F. Provide all new/relocated conduits terminating in switchgear, transformers, switchboards, and panelboards with grounding bushings, where required and ground wire extended to ground bus in equipment.
- G. Where modifications to the main service disconnect are required, main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- H. Interface with lightning protection system when lightning protection system is specified.
- I. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- K. Do not use spring steel clips and clamps.

- L. Do not use powder-actuated anchors.
- M. Do not drill or cut structural members.
- N. Do not use compression or mechanical connectors underground.

### 3.2 SYSTEMS OVER 600 VOLTS

- A. Provide insulated grounding bushings at each new/relocated conduit termination. The grounding system shall be made continuous with bare copper jumpers.
  - 1. Connect the copper grounding jumpers to the ground bus in the equipment.
- B. Install a grounding conductor in each conduit.
  - 1. 600 V code gauge Type XHHW.
  - 2. Green insulation.
- C. Connect the grounding conductor to:
  - 1. Each new/relocated/reused splice or pull box enclosure.
  - 2. Each new/relocated/reused transformer enclosure.
  - 3. All new/relocated/reused primary switchgear enclosures.

### 3.3 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be inside conduit, fittings and boxes and shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and other non-electrically continuous raceway fittings.
- B. Grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable PVC raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
- C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
- D. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Provide #6 ground conductor from telephone/voice/CATV/data company demarcation point to building electrical service entrance ground electrode connection and as required by all local utility companies.
  - 1. New MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico Cadweld #B544A028 ground bar with 7/16-inch holes, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the main electrical service disconnect.
  - 2. New IDF Closets Telecommunications Ground Bar (TGB): Provide Erico Cadweld #B542A004 ground bar with 7/16-inch holes, mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel.
  - 3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
  - 4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
  - 5. Bond each equipment rack with #6 AWG insulated ground conductor to the TMGB / TGB.
  - 6. Route TMGB – TGB ground conductor using the shortest route practical with long radius curves.
- E. Ground new and removed/replaced lighting fixture bodies to the conduit grounding system.
- F. Receptacles: Provide a ground wire bonded to the conduit ground system, except where and insulated isolated grounding receptacle is specified.

### EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

- G. Motor Frames: Ground the frame of each motor with a properly sized separate ground wire around flexible conduit.
- H. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
  - 1. Access well top shall be flush with finish paved surfaces.
  - 2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
  - 3. Provide thermal fusion (exothermic) connectors approved for direct burial.
- I. Ground all light poles and all exterior metal structures supporting conduit, switchgear, or light fixtures.
- J. Exterior Electrical Equipment Racks:
  - 1. Provide driven ground electrode for racks mounted remote from building structure.
  - 2. Where mounted on roof, ground to be building structural steel.
- K. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).
- L. Transformers: Provide driven ground electrode and building steel electrode at each transformer.
- M. Bond hot water and cold water piping together at each domestic water heater.

### 3.4 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

### 3.5 TESTING

- A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
  - 1. Inspect and test in accordance with NETA ATS except Section 4
  - 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13
- B. The Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.
- C. Two-Point Bonding Measurements: The two-Point Bonding test shall be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 ohms (100 milliohms).
- D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION

SECTION 26 05 33  
CONDUIT SYSTEMS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

- A. National Electrical Code  
B. Local codes and ordinances  
C. UL  
D. ETL

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

- A. Raceways:  
1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit.  
2. PVC Coated RGC: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions  
3. Stainless Steel: Robroy, Calbrite, Gibson  
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
- B. Fittings:  
1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Racor, Ipex, International Metal Hose, Lew Electric Fittings Co.  
2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions  
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds  
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
- C. Condulets and Conduit Bodies:  
1. Appleton, Form 85  
2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions  
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
- D. Steel MC Cable for light fixture whips:  
1. AFC  
2. Southwire  
3. General Cable  
4. Kaf-Tech

2.2 GENERAL

- A. The minimum conduit size shall be  $\frac{3}{4}$ -inch unless indicated otherwise in Divisions 26, 27 or 28.  
1. Branch Circuits: Minimum conduit size shall be  $\frac{3}{4}$ -inch.  
2. Feeder Circuits: Minimum conduit size shall be  $\frac{3}{4}$ -inches.  
3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be  $\frac{3}{4}$ -inches unless noted or indicated otherwise.  
4. The minimum conduit size between buildings for technology, voice, data, fire alarm, video,



security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.

- B. The minimum conduit size for flexible metallic conduit for tap connections to individual light fixtures shall be ½ inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.
- C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.
- D. BX and AC cable shall not be used on this project.
- E. PVC elbows shall not be used on this project.
- F. Intermediate metal conduit (IMC) shall not be used on this project.

## 2.3 RIGID METAL CONDUIT

- A. UL labeled, Schedule 40:
  - 1. Mild steel pipe, zinc coated inside and out
  - 2. Aluminum Alloy 6063, T-1 temper
  - 3. Threaded ends
  - 4. Insulated bushings
- B. Fittings shall meet the same requirements as rigid metal conduits.
  - 1. UL labeled
  - 2. Threaded fittings

## 2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. UL labeled, standard weight:
  - 1. Cold rolled steel tubing, zinc coated inside and out
  - 2. Aluminum Alloy 6005, 6063. Temper T-1
- B. Fittings shall meet the same requirements as EMT conduits.
  - 1. UL labeled
  - 2. Insulated throat connectors
  - 3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
  - 4. Cast metal fittings are not approved
  - 5. Uni-couple type connectors are not approved
  - 6. Split ring, anti-short bushings are not approved

## 2.5 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

- A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The PVC coating must have been investigated and verified by ETL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be ETL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are to be used. All conduit and fittings must be new, unused material. Applicable UL standards may include UL 6 Standard for Safety, Rigid Metal Conduit, and UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.
- B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek ETL SEMKO High Temperature H<sub>2</sub>O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.
- C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
- D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.

- E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.
- G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.
- H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
- I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).
- J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
- K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
- L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
  - 1. Conduit and conduit exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
  - 2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
  - 3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
  - 4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
- M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.
- N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

## 2.6 STEEL FLEXIBLE CONDUIT

- A. Steel flexible metallic conduit:
  - 1. Zinc coated inside and out
  - 2. 18-inches minimum length, 24-inches maximum length
- B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
  - 1. 18 inches minimum length; 6 feet maximum length
- C. Liquid tight flexible steel conduit
  - 1. Type L.A. - Grounded - UL Approved
  - 2. 18-inches minimum length, 24-inches maximum length

## 2.7 PVC CONDUIT

- A. UL labeled Schedule 40 and Schedule 80
- B. PVC fittings and solvent welded joints
- C. Acceptable PVC conduit manufacturer: Ipex, Cantex

2.8 CONDULETS AND CONDUIT BODIES

- A. UL Labeled
- B. Form 85
- C. PVC Coated: Form 8
- D. LBC Condulets shall be used for size 2 inch and above.
- E. LL and LR Condulets shall not be used for 2 inch and above

2.9 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

- A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof system with unistrut supports and accessories. Conduit supports shall allow for conduit expansion and contraction.
- B. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.
- C. Approved Manufacturer:
  - 1. Portable Pipe Hangers
  - 2. Eaton B-Line
  - 3. Miro Industries, Inc.

2.10 ALUMINUM CONDUIT

- A. UL Labeled
- B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel fittings.
  - 1. UL Labeled for use with aluminum conduit.

2.11 STAINLESS STEEL CONDUIT

- A. UL Labeled
- B. Rigid Stainless Steel:
  - 1. Type 304 Stainless Steel
  - 2. Threaded ends
  - 3. Insulated Bushings
- C. EMT:
  - 1. Type 304 Stainless Steel
  - 2. Compression Fittings
  - 3. Insulated Bushings
- D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
  - 1. Type 304 Stainless Steel

2.12 EXTERIOR IN-GRADE PULL BOXES

- A. Enclosures, boxes and covers are required to conform to all test provisions of the most current American Association of State Highway and Transportation Officials (AASHTO) standards for H-20 loading applications.
  - 1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized materials, rated for deliberate traffic.
  - 2. Conduit entry knock-outs as required
  - 3. Bolt down galvanized steel/cast iron covers
  - 4. Thin wall knocks outs as required

4. Integral bottom
5. Box height as required for specified conduit depth and required top elevation.
6. Concrete design strength of minimum 5,500 PSI at 28-days
7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.
8. Size and volume as required for application.

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA "Standard of Installation", concealed where possible.
  1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
  2. Arrange supports to prevent misalignment during wiring installation.
  3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
  4. Do not attach conduit to ceiling support wires.
  5. Arrange conduit to maintain head room and present neat appearance.
  6. Maintain 4-inch clearance between conduit and rooftop surfaces.
  7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
  8. Bring conduit to shoulder of fittings; fasten securely.
  9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
  10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
  11. Ground and bond conduit as required.
  12. Identify conduit as required.
  13. Route all conduits above building slab perpendicular or parallel to building lines.
  14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.
- B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.
- D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.
- E. Provide separate raceway systems for each of the following when specified, indicated or required:
  1. 120/208 volt circuits
  2. 277/480 volt circuits
  3. Emergency
    - a. Life safety branch
    - b. Critical branch
    - c. Equipment branch
  4. Voice/Data
  5. Sound reinforcement
  6. Theatrical and Architectural Dimming Controls
  7. MATV/CATV
  8. Security CCTV
  9. Security System
  10. Communications / PA Systems / Sound System Line Input and Speakers

11. Fire Alarm
  12. Lighting and Building Management Control Systems
- F. Unless shown otherwise, do not install conduit in or below concrete building slabs.
- G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.
- H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands as directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.
- I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer's approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.
- J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer's representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer's representative shall certify the installation is in accordance with manufacturer's installation instructions. Submit copies of installation certification prior to cover-up of underground installation.
- K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Provide insulated throat connectors for EMT conduits.
  2. Provide insulated bushing on all rigid conduit terminations.
  3. Provide locknuts inside and outside of all boxes and enclosures.
  4. Provide threaded type plastic bushing at all boxes and enclosures
- L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
  2. Do not support from metal roof deck.
- M. Completely install each conduit run and all bushings prior to pulling conductors. All boxes are to be accessible after completion of construction.
- N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pouring.
- O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.
- P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
1. Cable Tension:
    - a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
    - b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
    - c. 1000 lbs. per basket grip.
  2. Sidewall pressure: 500 lbs./ft.
  3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
    - a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
    - b. Two (2) equivalent 90-degree bends: not more than one hundred feet (100') between pull points.

- c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.
    - d. Straight pull: not more than two hundred feet (200') between pull points.
  - 4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
  - 5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
  - 6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
  - 7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
  - 8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
  - 9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
  - 10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.
- Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.
- R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.
- S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.
- T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.
- U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.
- V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.
- W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt "wings" are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or

fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.

- X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with "Tee" conduit at motor outlet height for flexible conduit.
- Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.
- Z. Where "LB" condulets are used, 2-inches and larger shall be type "LBD".
- AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.
- BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to the following: motorized equipment, transformers, interior light fixtures above ceilings, and power poles. They shall not be used in lieu of rigid conduit runs. They shall not be used for wall or roof penetrations except for exterior building mounted light fixtures and installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.
- CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.
- DD. "Daisy Chaining" light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.
- EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.
- FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.
- GG. Install minimum size 2-inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

### 3.2 CONDUITS

- A. Conduit above grade indoors:
  - 1. Concealed Conduits: EMT with steel set screw fittings
  - 2. Exposed conduits:
    - a. Below nine feet AFF where not directly attached and against building walls, ceiling, or structure: Rigid metal conduit.
    - b. Where subject to physical damage: Rigid metal conduit.
    - c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
    - d. Damp Locations: Aluminum rigid conduit.
    - e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel when installed below 18-inches above finished floor.
- B. Conduit installed above grade outdoors:
  - 1. Galvanized rigid steel for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
  - 2. Aluminum where not subject to physical damage and where located four feet above finished floor.
- C. Conduit where indicated underground:
  - 1. PVC Coated Galvanized rigid steel conduit elbows and Schedule 80 PVC, or PVC coated galvanized steel straight run conduits. PVC conduits for underground branch circuits shall be Schedule 80 or Schedule 40 PVC.

- a. PVC conduit and fittings shall be used only for straight horizontal runs and for vertical risers at site lighting pole bases. Bending straight sections of PVC conduit to less than 25-foot radius or the use of PVC factory bends is not allowed.
  - b. Change in direction of conduit runs, either vertical or horizontal, shall be with PVC coated galvanized steel elbows or long sweep bends of straight PVC conduit sections. Long sweep bends of straight PVC 20-foot sections shall have a minimum radius of curvature of 25 feet and a maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC sections shall be separated by a minimum of 20-feet of straight, linear, PVC sections.
  - c. Provide PVC coated rigid galvanized steel conduit elbows and fittings with urethane interior coating at all changes in direction with radius of less than 25-feet and at all vertical runs to 18 inches above finished floor elevation. For interior slab penetrations, provide continuous PVC coated rigid galvanized steel conduit and fittings with urethane interior coating from change in direction to 18 inches above finished floor elevation, except where stubbed-up under and inside equipment or switchgear where conduit shall be terminated at minimum two inches above concrete housekeeping pad.
  - d. Elbows for underground electrical service entrance, feeders, transformer primary / secondary, telecommunication, and low voltage conduits shall be PVC coated rigid galvanized steel with long radius as follows:
    - 1) Up to 1-inch conduit, minimum 12-inch radius.
    - 2) 1.5-inch conduit, minimum 18-inch radius.
    - 3) 2-inch conduit, minimum 24-inch radius.
    - 4) 2.5-inch conduit, minimum 30-inch radius.
    - 5) 3-inch conduit, minimum 36-inch radius.
    - 6) 3.5 to 6-inch conduit, minimum 48-inch radius.
  - e. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.
  - f. Conduits shall not be routed horizontally in building slab, grade beams or pavement.
2. Underground conduits:
- a. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications.
  - c. Provide conduit spacers for parallel branch/feeder conduits.
  - d. Conduits either specified or approved in writing to be routed under building slab for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
  - e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of conduit 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of conduit at 36 inches minimum below finished grade or pavement.
4. Provide two "caution" plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
5. Conduits located outside the building, provide magnetic locator tape at top of first compacted layer of backfill.
6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit



- plugs shall then be installed.
7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
  8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product a minimum strength of 2,500 PSI.
  9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
  10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.
- D. Conduit shown in concrete walls, floor or roof slab:
1. PVC Coated Galvanized Rigid steel.
- E. Conduits that penetrate concrete slabs, or within 100 feet of cooling towers, or at designated corrosive locations.
1. PVC coated galvanized rigid steel
- F. Connections to motorized equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
  2. Liquid tight flexible metal conduit length shall be between 18 and 24 inches
  3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures for all power routed through roof curb and to the roof mounted equipment and accessories.
- G. Light fixture whips:
1. Accessible ceilings and open structure: 1/2-inch flexible steel conduit or steel MC cable, length not to exceed 6-feet.
  2. Non-accessible ceilings: 1/2-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture's integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
  3. Dedicated insulated ground wire.
  4. Light fixture whips shall not rest on ceiling grid or tile.
  5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit and steel MC cable shall be kept a minimum of 2 inches clear of roof deck.
- H. Conduits at Natatorium or therapeutic pool areas:
1. Underground conduit shall be as specified in this section.
  2. Exterior conduits and boxes within 100 feet of exhaust openings shall be PVC coated galvanized rigid steel or stainless steel.
  3. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms shall be Schedule 80 PVC. Boxes shall be PVC, or 304 Stainless Steel.
  4. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.
- I. Conduits located inside greenhouses and natatorium pump and water treatment rooms:
1. Schedule 80 PVC
  2. PVC coated galvanized rigid steel conduit and fittings.

### 3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

- A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
  - 1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
  - 2. Sleeves shall extend 3-inches above the finished floor.
- B. Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.
- C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.
- D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to install a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.
- E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.
- F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.
- G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.4 POWER DISTRIBUTION UNDERGROUND FEEDER CONDUIT AND UNDERGROUND SERVICE ENTRANCE CONDUIT

- A. Power underground feeder and service entrance shall be of individual conduit. Unless shown otherwise, the type of conduit used shall not be mixed in any one underground conduit and shall be the size indicated on the drawings. Conduit for 120V and above shall be separated from control and signal conduits by a minimum of 3-inches.
- B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
- D. Conduit for service entrance underground conduits shall be as indicated on the drawings.
- E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

- A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.
- B. Completely install all conduit runs and all bushings prior to pulling conductors. All boxes shall be

accessible after completion of construction.

- C. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.
1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
  2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
  3. Provide two conduits for each multi-media outlet box and each outlet box indicated to contain more than four data, audio, or video drops to accessible ceiling plenum.
  4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
    - a. Non-masonry outlet box: Two 1-inch conduits.
    - b. Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
    - c. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.
- D. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling and be turned horizontally with plastic bushing at terminations.
- E. Conduits for Building Entrance Facilities:
1. Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
  2. Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.
  3. Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
  4. Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
  5. Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.

### 3.6 EXTERIOR IN-GRADE PULL BOXES

- A. Provide pull boxes where specified and as required.
- B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.
- C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

### 3.7 IDENTIFICATION

- A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at

spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION 26 05 33



SECTION 26 05 35

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

- A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

- A. UL Label: Products shall be UL listed to the extent possible.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.
- B. Raceways: Refer to related sections.
- C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.
- D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.
- B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.
- C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.
- D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.
- E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.
- F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable conduit, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For all AHU or fan motors and all other motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.

ELECTRICAL CONNECTIONS FOR EQUIPMENT

- G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:
1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with equipment installation work. Where equipment manufacture does not permit a bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.
  2. Where conduit originates from an elevation above the conduit entry, provide a "T" conduit below the enclosure's bottom elevation. Provide conduit from the conduit up to the enclosure bottom horizontal surface for electrical connection.
  - 3.
- H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.
- I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.
- J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION

SECTION 26 05 37

ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS– Provide products manufactured in the USA

2.1 FABRICATED MATERIALS

- A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.
1. Type of Various Locations:
    - a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
    - b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
    - c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
    - d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
    - e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
    - f. Surface: Type FS or FD box with surface cover.
    - g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
    - h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
    - i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
  2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.
- B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.
- C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.
- D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
1. Type for Various Locations:
    - a. Minimum Size: 4-inch square, 2-1/8-inches deep.

ELECTRICAL BOXES AND FITTINGS



- b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
  - c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners
- E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.
- F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.
- G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF BOXES AND FITTINGS

- A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.
- B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.
- C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.
- D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.
- E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.
- F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.

## ELECTRICAL BOXES AND FITTINGS

- G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.
- H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.
- I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.
- J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- K. Provide knockout closures to cap unused knockout holes in boxes.
- L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
- M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.
- N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.
- O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
- P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
- Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.
- R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull boxes located above accessible ceilings or non-finished areas to correspond to the following colors:
  - 1. Orange: - 480/277 VAC systems
  - 2. Light Blue: - 240 VAC three phase delta systems.
  - 3. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
  - 4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems
  - 5. Yellow – Building Management and Control System - BMCS
  - 6. White - Security and Surveillance equipment circuits
- S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example "MSB to Panel HA"). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example "LA2" referring to Panel LA sec. 2 is to be listed as "LA"). Label covers for special applications explaining contents (example "Emerg. Gen. Annunciator controls", "IDF ground"). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example "Not Used Panel LA". Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.
- T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
- V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

ELECTRICAL BOXES AND FITTINGS

- W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.
- X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- AA. Use adjustable steel channel fasteners for hung ceiling outlet box.
- BB. Do not fasten boxes to ceiling support wires.
- CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.
- DD. Use gang box where more than one device is mounted together. Do not use sectional box.
- EE. Use gang box with plaster ring for single device outlets.
- FF. Support outlets flush with suspended ceilings to the building structure.
- GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
- HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.
- II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.
- JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.
- KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.
- LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.
- MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
- NN. Bond equipment grounding conductor to all junction and pull boxes.
- OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.
- PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.
- QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.2 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

END OF SECTION



SECTION 26 05 40

ELECTRICAL GUTTERS AND WIREWAYS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide electrical gutter work as shown, as specified and as required.
- B. Application: The types of electrical gutters required for the project include the following:
  - 1. Electrical wiring gutters
  - 2. Voice / Data / Video / Communication and signal distribution wireway

1.2 QUALITY ASSURANCE

- A. UL Label: Gutters and wireways shall be UL labeled.

PART 2 – PRODUCTS

2.1 ELECTRICAL GUTTERS AND WIREWAYS

- A. General: Provide hinged electrical gutters and wireways in the types and sizes indicated or required, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards; with features required.
- B. Size: Provide size indicated. Where size is not indicated, construct in accordance with the NEC and other standards. Gutters shall be of manufacturer's standard lengths, without field cutting or field extensions.
- C. Accessories: Provide gutter and wireway accessories where indicated, constructed of same metal and finish as gutters or wireways.
- D. Supports: Provide gutter and wireway supports indicated, conforming to NEC, and as recommended by the manufacturer, and as specified in Section 26 05 33 Conduit Systems.
- E. Materials and Finishes: NEMA 1 gutters and wireways shall have gray powder coat finish over galvanized steel. Gutters and wireways installed outside shall be NEMA 3RX minimum. Gutters or wireways installed within 100-feet of cooling towers, at kitchen or food preparation areas, and natatorium, spa or therapy pool areas shall be of 304 stainless steel NEMA 4X construction.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Provide gutters and wireways only where specified or required. Use of gutters and wireways shall be kept to a minimum.
- B. Finishing: Remove burrs and sharp edges of gutters and wireways wherever they could be injurious to conductor insulation or jacket.
- C. Installation: Install gutters and wireways where shown or required, in accordance with the manufacturer's written instructions, NEC, NECA "Standard of Installation," and with recognized industry practices to ensure that the gutters and wireways comply with the specified requirements. Comply with requirements of NEMA and the NEC pertaining to installation of electrical gutters.
- D. Grounding: Electrically ground gutters and wireways to ensure continuous electrical conductivity. Provide equipment grounding conductor.
- E. Conductors:
  - 1. Complete gutter and wireway installation before starting the installation of conductors.
  - 2. Provide sufficient space to permit access for installing, splicing, and maintaining the

ELECTRICAL GUTTERS AND WIREWAYS

conductors.

- F. A maximum of 12 conduits containing branch circuits shall be allowed to be installed in any gutter or wireway.

END OF SECTION

SECTION 26 05 50

FIRESTOPS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson
- B. 3M (Minnesota Mining Manufacturing)
- C. Hilti
- D. Specified Technologies, Inc.
- E. Metacaulk

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 – EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION





SECTION 26 08 00

ELECTRICAL AND LIFE SAFETY SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

- 1.1.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.1.2. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2. SUMMARY

- 1.2.1. The purpose of this Section is to define responsibilities in the Commissioning Process. Other electrical system testing is required under other Division 26 Specification Sections. National Electrical Installation Standards (NEIS) NECA 90-2004, "Recommended Practice for Commissioning Building Electrical Systems", 27<sup>th</sup> Volume of the NEIS Series, provides additional guidance for the commissioning of electrical systems.
- 1.2.2. Commissioning requires the participation of the Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. General Commissioning Requirements are provided separately and coordination is detailed in Division 01. Division 26 and 28 Contractors shall be familiar with all parts of Division 01, the General Commissioning Requirements and the Commissioning Plan issued by the Owner's CxA, shall execute all Commissioning responsibilities assigned to them in the Contract Documents and include the cost of Commissioning in the Contract price.
- 1.2.3. Electrical Testing Agency (ETA)
  - 1.2.3.1. The Contractor shall retain an independent Electrical Testing Agency (ETA). Their specific testing responsibilities are delineated in individual technical sections within Division 26. This generally requires checking and testing of the electrical power distribution equipment per National Electrical Testing Association (NETA) Acceptance Testing Standards (ATS).
  - 1.2.3.2. Attend, as needed, Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Contractor, Owner or CxA to facilitate the Commissioning process.
  - 1.2.3.3. Obtain all required manufacturer's data to facilitate tests.
  - 1.2.3.4. Provide assistance to the CxA in preparation of the specific System Verification Checklists (SVC) and Functional Performance Test procedures.
  - 1.2.3.5. Generally, the ETA shall provide their standard forms to document the NETA tests to be incorporated into the System Verification Checklists and Functional Performance Test records.
  - 1.2.3.6. The ETA shall assist the Contractor in completing required SVC information such as relay settings, protective overload settings, and equipment ratings utilizing the protocols in the Commissioning Plan.
  - 1.2.3.7. Perform and clearly document all completed Start-up and system operational checkout procedures, providing a copy to the Contractor.
  - 1.2.3.8. Clearly indicate any deficiencies identified during testing and add to an action list for resolution and tracking. The field technicians shall keep a running log of events and issues.
  - 1.2.3.9. Provide skilled technicians to execute testing. Ensure that they are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
- 1.2.4. Electrical systems to be commissioned include the following:
  - 1.2.4.1. Unit Substations / Electrical Switchboards

ELECTRICAL AND LIFE SAFETY SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

- 1.2.4.2. Secondary Normal Power Distribution
- 1.2.4.3. Emergency / Standby Power Distribution
- 1.2.4.4. Branch Power Distribution and Components
- 1.2.4.5. Emergency Generators and Paralleling Switchgear
- 1.2.4.6. Uninterruptible Power Supplies (UPS)
- 1.2.4.7. Lighting Controls - Occupancy Sensors (25% greater than 25 sensors installed, 100% less than 25 sensors installed)
- 1.2.4.8. Lighting - Daylight Controls (100%)
- 1.2.4.9. Lighting - Time Switch Controls (100%)

### 1.3. DEFINITIONS

- 1.3.1. Refer to Division 01: General Commissioning Requirements for definitions.

### 1.4. SUBMITTALS

- 1.4.1. Contractor shall provide Owner and / or CxA with documentation required for Commissioning Work. At minimum, documentation shall include: Detailed Start-up procedures, full sequences of operation, Operating and Maintenance data, performance data, control drawings, and details of Owner-contracted tests.
  - 1.4.1.1. Shop drawings and product submittal data related to systems or equipment to be commissioned.
- 1.4.2. Contractor shall submit to Owner and / or CxA installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
- 1.4.3. Where installation testing may be performed in a progressive manner (i.e. grounding systems, insulation resistance, etc.), the Contractor shall prepare and submit to the Owner, A/E team and CxA a testing plan that details how the progressive testing will be performed, documented and presented for approval prior to the start of any testing activities.
- 1.4.4. Contractor shall provide Owner with documentation required for Commissioning work. At minimum, documentation shall include: Detailed Start-up procedures, Full sequences of operation, Operating and Maintenance data, Performance data, Functional Performance Test Procedures, Control Drawings, and details of Owner-Contracted tests.
- 1.4.5. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process
  - 1.4.5.1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.
  - 1.4.5.2. Incorporate manufacturer's initial energizing / startup procedures with System Verification Checklists.
  - 1.4.5.3. Final Electrical Testing Agency (ETA) Reports documenting all NETA requirements indicated in the Project Documents
  - 1.4.5.4. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.
  - 1.4.5.5. Operating and Maintenance (O&M) information per the requirements of the Technical Specifications and Division 01 requirements.

## PART 2 - PRODUCTS

### 2.1. GENERAL

- 2.1.1. All materials and installation shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- 2.1.2. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process

- 2.1.3. Contractor is required to follow all applicable industry and site specific safety practices, lockout / tagout requirements, specialized PPE requirements, and provide qualified, trained personnel to execute Commissioning Process requirements.

## 2.2. TEST EQUIPMENT

- 2.2.1. The Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.
- 2.2.2. 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.

## PART 3 - EXECUTION

### 3.1. CONSTRUCTION PHASE

- 3.1.1. In each purchase order or subcontract that is written for changes in scope, include the appropriate requirements for submittal data, Commissioning documentation, testing assistance, Operating and Maintenance (O&M) data, and training, as a minimum.
- 3.1.2. Attend Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Owner, CxA or Contractor to facilitate the Commissioning process.
- 3.1.3. Provide manufacturer's data sheets and shop drawing submittals of equipment.
- 3.1.4. Provide additional requested documentation to the Owner and / or CxA, prior to O&M manual submittals, for development of System Verification Checklists and Functional Performance Testing procedures.
  - 3.1.4.1. Typically, this will include detailed manufacturer's installation and Start-up, operating, troubleshooting and maintenance procedures, full details of any Owner-contracted tests, full factory testing reports, if any, and full warranty information.
  - 3.1.4.2. In addition, the installation, Start-up, and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Contractor and / or CxA.  
This information and data request may be made prior to normal submittals.
- 3.1.5. With input from the Lighting Controls, PCMS vendors and A/E, clarify the operation and control of commissioned equipment in areas where the Specifications, control drawings, or equipment documentation are not sufficient for writing detailed test procedures.
- 3.1.6. During the installation, Start-up and initial checkout process, execute and document related portions of the System Verification Checklists for all commissioned equipment according to the procedures indicated in the Commissioning Plan.
- 3.1.7. Factory Start-ups: Factory Start-ups are specified for certain equipment. Factory Start-ups generally are Start-up related activities that will be reviewed and checked prior to Functional Performance Tests. All costs associated with factory Start-ups shall be included with the contract price unless otherwise noted. Notify the Commissioning Team of the factory Start-up schedule and coordinate these factory Start-ups with witnessing parties. The Commissioning Team members may witness these Start-ups at their discretion.
- 3.1.8. Independent Testing Agencies: For systems that specify testing by an independent testing agency, the cost of the test shall be included in the Contract price unless otherwise noted. Testing performed by independent agencies may cover aspects required in the System Verification Checklists, Start-ups, and Functional Performance Tests. Coordinate with the independent testing agency so that CxA, Owner and/or A/E can witness the test to ensure that applicable aspects of the test meet requirements.

## ELECTRICAL AND LIFE SAFETY SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

- 3.1.9. Provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.
- 3.1.10. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and A/E and retest the system and equipment.
- 3.1.11. During construction, maintain as-built marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. Update after completion of Commissioning activities (include deferred tests).
- 3.1.12. Provide training of the Owner's operating personnel as specified.
- 3.1.13. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
- 3.2. WARRANTY PHASE
  - 3.2.1. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.
    - 3.2.1.1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.
  - 3.2.2. Correct deficiencies and make necessary adjustments to O&M manuals, Commissioning documentation, and as-built drawings for applicable issues identified in any deferred or seasonal testing.
- 3.3. INSTALLATION
  - 3.3.1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
  - 3.3.2. All installation shall be in accordance with the Project Documents.
- 3.4. TRAINING
  - 3.4.1. Refer to the individual section of this Specification for specific training requirements on each system.
    - 3.4.1.1. Refer to the General Commissioning Requirements and Division 01 of the Project Specifications for overall training requirements related to the Commissioning process and this project.

SECTION 26 09 25

ELECTRICAL CONTACTORS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by one of the following:  
Schneider Electric - Square D  
ABB-General Electric  
Siemens

2.2 CONTACTORS

- A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
  2. Contacts shall be readily replaceable, self-aligning, silver alloy.
  3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
  4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
  5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
  6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.
- B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
  2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
  3. Normally open contactors shall be spring-loaded open and magnetically closed.
  4. Contactors for emergency lighting or power shall be normally closed.
- C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.
- D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.
- E. Enclosure:
1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.
  2. Contactors and control enclosures installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.
- F. Minimum interrupting rating shall be 35KAIC.

PART 3 – EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

ELECTRICAL CONTACTORS

- A. Provide electrically held contactors, with line side wiring complete, in accordance with the National Electrical Code and manufacturer's recommendations.
- B. Fuses: Install fuses where coil control power is fed from line side of contactor.
- C. Adjustment: Adjust operating mechanisms for free mechanical movement.
- D. Coordinate contactor control and operation requirements with the Building Management Control System.
- E. Identify each contactor as specified in Section 26 05 00.
- F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

### 3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

- A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.
- B. Where control is a three-wire momentary control signal, provide control interface to operate electrically held 2-wire control contactors.
- C. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.
- D. Provide normally closed contactors for circuits controlled by "emergency power off" or teacher control switches in science classrooms, computer labs, and vocational instructional areas.
- E. Exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both "ON" and "HIGH" settings.

END OF SECTION

SECTION 26 09 28

DIGITAL LIGHTING CONTROLS – CY-FAIR ISD

PART 1 - GENERAL

1.1 INTRODUCTION

- A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.
- B. Contractor shall provide to the digital lighting control equipment manufacturer all quantities for system including but not limited to room controllers, occupancy sensors, button stations, photocells, emergency lighting controllers, and wire lengths for room controller communications bus.
- C. Contractor shall demonstrate to the Owner, the complete successful operation of system including but not limited emergency lighting operation. Demonstration shall occur a minimum of 30 days prior to the contract schedule completion date. Installing electrical contractor shall replace any failed material during warranty period of one year at no additional cost to the Owner.
- D. Refer to the drawings and other specifications in Division 23 and 26 regarding lighting controls for exterior lighting and other interior areas indicated for control by the Building Management Control System (BMCS) or other means other than the digital lighting controls specified in this section.
- E. Factory startup and commissioning for substantial completion, 90-day verification re-commissioning, and 11-month close-out commissioning shall be provided.

1.2 QUALITY ASSURANCE

- A. Component Pre-testing: All components and assemblies are to be factory pre-tested and burned-in prior to installation.
- B. NEC Compliance: Comply to NEC as applicable to electrical wiring work.
- C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

1.3 SYSTEM DESCRIPTION & OPERATION

- A. The lighting control system as defined under this section covers the following equipment for local room or local area networks only. Building wide network equipment is not required and shall not be provided unless those capabilities are inherent to the base components required or specified for local room controls only.
  - 1. Digital Room Controllers – Self-configuring, digitally addressable relay controllers with 0-10-volt dimming control for lighting and single relay application-specific plug load controllers when plug load control is specified or required.
  - 2. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
  - 3. Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
  - 4. Digital Photosensors – If Code required, single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications that can provide switching or dimming control for daylight harvesting.
  - 5. Configuration Tools – Handheld remote for room configuration provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings.
  - 6. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.



7. DLM Lighting control system components shall have the capability to be easily expanded in the future to a building wide network functionally using all of the following topologies: a fully wired network.
- B. Lighting controls and automation for exterior lighting and interior areas not controlled by the system specified in this section shall be as required and as specified by other specification sections in Division 23, and 26.
- C. Power and communications for lighting controls provided shall be wired. Use of batteries or wireless communications is prohibited. Dimming control wiring shall not be installed with any line voltage power wiring conduits.

#### 1.4 SUBMITTALS

- A. Submit the specification line-by-line compliance review, shop drawings, and the product data specified below under one cover as a complete submittal.
  1. Specification compliance review: refer to Electrical Shop Drawings specification section for instructions and additional information.
  2. Shop Drawings:
    - a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
    - b. Scale drawing for each area showing the exact location of each sensor, room controller, and digital switch.
  3. Product Data: Catalog sheets, specifications and installation instructions.
    - a. Include data for each device which:
    - b. Indicates where sensor is proposed to be installed.
    - c. Prove that the sensor is suitable for the proposed application.

#### 1.5 WARRANTY

- A. Wattstopper Digital Lighting Management (DLM) control products: Provide a five-year complete manufacturer's warranty on all products to be free of manufacturers' defects.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. WattStopper (Legrand North America, LLC)
  1. System: Digital Lighting Management (DLM). No Substitutions.

#### 2.2 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- A. Ceiling mounted (or where specifically indicated or required to be wall mounted to suit installation); passive infrared (PIR), ultrasonic, or dual technology (passive infrared and ultrasonic) digital occupancy sensor. Furnish the system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
  1. Digital calibration and pushbutton programming for the following variables:
    - a. Sensitivity – 0-100% in 10% increments
    - b. Time delay – 1-30 minutes in 1-minute increments
    - c. Test mode – Five second time delay
    - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - e. Walk-through mode
    - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
  2. One or two RJ-45 port(s) for connection to DLM local network.
  3. Two-way infrared (IR) transceiver to allow remote programming through handheld

- commissioning tool and control by remote personal controls.
- 4. Device Status LEDs including:
  - a. PIR Detection
  - b. Ultrasonic detection
  - c. Configuration mode
  - d. Load binding
- 5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
- 6. Manual override of controlled loads.

- C. Units shall not have any dip switches or potentiometers for field settings.
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required.
- E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC, LMDW

## 2.3 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations; grey, compatible with building standard stainless-steel wall plates with decorator opening. Wall switches shall include the following features:
  - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
  - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  - 3. Red configuration LED on each switch that blinks to indicate data transmission.
  - 4. Blue Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
  - 5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
- B. Two RJ-45 ports for connection to DLM local network.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.
- D. The following switch attributes may be changed or selected using a wireless configuration tool:
  - 1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
  - 2. Individual button function may be configured to toggle, ON only or OFF only.
  - 3. Individual scenes may be locked to prevent unauthorized change.
  - 4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
  - 5. Ramp rate may be adjusted for each dimmer switch.
  - 6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
- E. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101.

## 2.4 ROOM CONTROLLERS

- A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and shall not have dip switches, potentiometers or require special configuration. The control units shall include the following features:
  - 1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
  3. Device Status LEDs to indicate:
    - a. Data transmission
    - b. Device has power
    - c. Status for each load
    - d. Configuration status
  4. Quick installation features including:
    - a. Standard junction box mounting
    - b. Quick low voltage connections using standard RJ-45 patch cable
  5. Plenum rated
  6. Manual override and LED indication for each load
  7. Dual voltage (120/277 VAC, 60 Hz)
  8. Zero cross circuitry for each load.
- B. ON/OFF/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
  2. One, two or three relay configurations
  3. Efficient 250 mA switching power supply
  4. Four RJ-45 DLM local network ports.
  5. One 0-10-Volt analog output per relay for control of compatible LED drivers.
  6. The following dimming attributes may be changed or selected using a wireless configuration tool:
    - a. Establish preset level for each load from 0-100%
    - b. Set high and low trim for each load
  7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
    - a. One relay configuration only
    - b. Automatic-ON/OFF configuration
  8. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMPL-201,

## 2.5 DIGITAL PHOTSENSORS

- A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.
- B. Digital photosensors include the following features:
1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
  2. Sensor light level range shall be from 1-10,000 footcandles (fc).
  3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
  4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling after they turn off.
  5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
  6. Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or raise and lower lighting levels for a selected period of time or cycle of occupancy.
  7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

8. Red configuration LED that blinks to indicate data transmission.
  9. Blue status LED indicates test mode, override mode and load binding.
  10. Recessed switch to turn controlled load(s) ON and OFF.
  11. One RJ-45 port for connection to DLM local network.
  12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.
- C. Closed loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
  2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
  3. Automatically establishes setpoints following self-calibration.
  4. A sliding setpoint control algorithm for dimming daylight harvesting with a "Day Setpoint" and the "Night Setpoint" to prevent the lights from cycling.
  5. WattStopper Product Number: LMLS-400.
- D. Open loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
  2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
  3. A proportional control algorithm for dimming daylight harvesting with a "Setpoint" to be maintained during operation.
  4. WattStopper Product Number: LMLS-500.

## 2.6 ROOM OR AREA NETWORK

- A. The DLM local network shall be a free topology lighting control physical connection and communication protocol. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. The DLM local network shall include:
1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
  2. Simple replacement of any device in the network with a standard off-the-shelf unit without requiring commissioning, configuration or setup.
  3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
  4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30-feet from a sensor, wall switch or IR receiver.

## 2.7 CONFIGURATIONS TOOLS

- A. A configuration tool facilitates optional customization of DLM local networks and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include:
1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30-feet.
  2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
  3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
  4. Save up to nine occupancy sensor setting profiles and apply profiles to selected sensors.
  5. Temporarily adjust the light level of any load(s) on the local network and incorporate those levels in scene setting.

6. Adjust or fine-tune daylighting settings established during auto-commissioning and input light level data to complete commissioning of open loop daylighting controls.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

## 2.8 EMERGENCY LIGHTING

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF/Dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting to be fully bright ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz., 20-amp driver rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface.

B. WattStopper Product Numbers: ELCU-200.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION:

- A. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Provide a minimum of eight hours of on-site technical support for the coordination between the BMCS and the Wattstopper lighting controls. Ensure that the sequences of operation involving the BMCS are fully operational as specified and as required.
- B. The installing contractor shall, prior to request of WattStopper factory start up and site commissioning, request an on-site meeting by including local factory representative, Owner and the general contractor, to assist in identification of any open-ended issues, thereby eliminating potential for delays and system commission interruptions.
- C. Upon confirmation of progress by local factory authorities, the installation electrical contractor shall complete the start-up request form found in the WattStopper submittals, including any field changes from the contract documents. This is essential to facilitate substantial completion.
- D. Room controllers shall be installed so that they are easily accessible for replacement or maintenance:
  1. Mount lighting control equipment to junction boxes as recommended by the manufacturer.
  2. Where accessible ceiling heights are 10-feet AFF or less, room controllers shall be mounted on wall above local control switch location between 4 and 18-inches above the accessible ceiling and 2-inches clear of T-grid for above ceiling access.
  3. Where ceiling heights are above 10-feet, room controllers shall be mounted in an ancillary area above the ancillary area local control switch location with accessible ceiling of 10-feet or less. The high ceiling room controller shall be mounted adjacent to the lower ceiling room controller serving the ancillary area. The room controller for the high ceiling and ancillary area(s) may utilize the same room controller for each area if practical. If an ancillary area with low accessible ceiling area is not available, the room controller shall be installed in the same mechanical or electrical room as the electrical panel serving the lighting for that area and clearly labeled for its use and specific room that it controls.
  4. Smaller ancillary spaces not separated by doors that adjoin the larger space do not require an additional control zone and shall be controlled with the larger adjoining space zone to reduce complexity.
- E. Lighting controls shall meet the minimum requirements of all local codes in effect when the project will be permitted with whatever exceptions deemed appropriate by the Owner. Wherever possible, minimize the complexity of the controls design to reduce the quantity and types of required sensor hardware, low voltage and line voltage wiring:
  1. Provide UL 924 emergency load control devices so that designated emergency interior light fixtures will be controlled ON/OFF/dimmed with adjacent area lighting and be brought to full-bright ON during power failure.

2. Provide full floor area occupancy/vacancy sensor coverage wherever sensors are required.
  3. Provide 20-minute time out delay where vacancy sensor control is provided or required.
  4. Provide 20-minute or IECC maximum time out delay, whichever is shortest, where occupancy sensor control is provided or required.
- F. Where daylighting controls are required or indicated they shall be fully automatic and full range dimming without local user overriding of the daylighting maximum light level set point or trim level. Local user override to dim to OFF shall be provided. A single photo sensor shall be interfaced with the room controller for each daylighting zone in an area and for each cardinal direction as required by the IECC, and as recommended by the lighting control system vendor.
- G. Low voltage cabling installed above ceiling shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices. Low voltage control wiring shall not be installed in the same raceway with line voltage wiring.
- H. Renovation areas: Utilize existing wall box switch locations where line voltage wiring is removed and therefore can be utilized for low voltage control controls and control cabling unless shown or noted otherwise.

### 3.2 GENERAL SEQUENCES OF OPERATION

- A. Refer to plan and plan details for additional information for specific areas and additional requirements. Where plans or plan details are in conflict with these specifications, provide the more stringent of the two, however verify with the Owner/Architect for clarification for the exact requirements to be provided prior to construction at no additional cost to the Owner.
- B. Areas with lighting that requires dimming: Manual ON shall initially bring the lighting level to lighting control system 80-percent set point but not lower than the minimal CFISD design standard-maintained foot-candela light level for the type of space served. Refer to CFISD's Electrical-Light Fixture standards for required maintained light levels. Contractor/vendor shall verify in the field with CFISD during the commissioning process typical acceptable light levels with all ceilings and walls installed and with final paint and finishes applied. It is CFISD's intention to adjust the trim points to a minimally acceptable light level and only adjust as needed due to light fixture lumen depreciation over the lifetime of the light fixtures. This will increase energy savings and extend the lifetime of the lighting system.

### 3.3 SEQUENCES OF OPERATION FOR SPECIFIC AREAS – REFER TO PLAN DETAILS FOR ADDITIONAL PROJECT SPECIFIC INFORMATION AND INSTRUCTIONS

- A. CORRIDORS, STUDENT AND PUBLIC TOILETS/RESTROOMS ACCESSIBLE DIRECTLY FROM CORRIDORS, AND STAIRS: Includes all hallways and other egress pathways, including attached open access without doors, ancillary spaces such as flex or collaboration spaces, student and public toilets/restrooms with or without a door open to corridor, (This does not include large areas open to the corridor pathway such as the adjoining seating areas of cafeteria, dining, commons, nor shall it include administrative staff toilets or restrooms).
1. Control through BMCS. BMCS occupied (turn ON) or unoccupied (turn OFF) state sent to DLM room controllers. Single DLM occupancy sensor and Hubbell key switch at each security keypad. Sensor to be used for auto ON only; sensor shall not turn corridor lights OFF. Dimming only if required for code required daylight harvesting.
  2. Provide DLM occupancy sensor for body movement detection in corridors (maximum spacing 50-feet) to only turn all corridor lights ON. Provide hand motion sensor coverage in adjoining toilets/restrooms. Provide a DLM Hubbell momentary SPDT key switch next to each security keypad to manually turn corridor lights ON only (to be used if there is a DLM sensor failure or BMCS failure or if BMCS is in un-occupied state). Key switch shall not turn lights OFF. Any corridor occupancy sensor shall trigger all corridor DLM room controllers to turn lights ON at any time of day and will remain ON until a BMCS unoccupied state in which the lights shall turn OFF.

3. Corridors and their attached open access ancillary general use spaces and attached student/public toilets with or without corridor doors shall be grouped together. Do not switch general use ancillary spaces including student/public toilets with or without doors separately from the corridor that have direct access from an adjoining corridor.
  4. Flex or collaboration spaces open to corridors shall be a separate dimming control zone but shall be grouped with the adjoining corridor's occupancy sensors and BMCS control for BMCS ON/OFF and sensor ON.
  4. Corridor Hubbell SPDT key switch shall be located at each security system control keypad and shall have both load terminals shunted so that either up or down position will turn the lights ON. Label key switches as "CORRIDOR LTG ON".
  5. Do not provide a fire alarm interface since sensors do not turn lights OFF.
  6. DLM locations and quantities shall be kept to a minimum. Multiple corridors shall be grouped and controlled together as much as practical. Individual corridors do not require individual local controls. All corridors are either all on or all off.
  7. Lighted display cases in corridors: Circuit with corridor lighting and with additional local manual line voltage key switch required by IECC identified as "CASE LTG".
  8. Provide separate local switching or dimming for open ancillary flex spaces only if indicated.
  9. No light switches in enclosed stairs. Switch and control all stair floor landings with the first-floor corridor except that one or more light fixture at each floor landing shall be controlled with that respective floor's corridor lighting. Do not provide sensors in stairs. Un-enclosed stairs shall be considered an extension of the adjoining corridor or space and shall share the adjoining corridor or space-controlled lighting line voltage circuits/zone. Do not provide a separate zone for un-enclosed stairs open to adjoining spaces.
- B. INSTRUCTION AND ADMINISTRATIVE AREAS, OFFICES, LOUNGES/BREAK ROOMS, COPY/PRINT ROOMS, AND SIMILAR AREAS, STORAGE ROOMS THAT ARE 100 SQUARE FEET AND LARGER.
1. SEQUENCE: Provide vacancy sensor control (DLM system manual ON/OFF, auto OFF, DIM).
  2. Instructional areas, classrooms, and large group instruction up to 99-person occupancy provide single zone dimming with DLM control at each entry door. Provide additional zones if the room is equipped with room divider partitions.
  3. Large Group Instruction over 100-person occupancy: Provide up to three dimming zones, one over the presentation display area, one over the seating area, and one for any other specialty lighting or enhanced zone functionality. Provide DLM system master control station only at the main entry door or near the presentation area. Provide entry station(s) at each entry door to provide ON/OFF general lighting.
- C. SHOPS, KITCHEN, FOOD SERVING QUEUE, AND NATATORIUM
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights off. No occupant sensors for safety and security. Local DLM switches also function as a local override. No dimming
  2. Kitchen/serving: Manual local DLM switches. Locate kitchen/serving switches in supervised locations for on/off control. Occupancy sensor for auto ON only, sensor shall not turn kitchen/serving lights OFF. No dimming (health code lighting requirement supersedes IECC).
  3. Shops: Provide lighting with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls or dimming. Occupancy sensor for auto ON only, sensor shall not turn shop lights OFF. No dimming.
  4. Natatorium: Safety and security: BMCS unoccupied state shall turn lights OFF. No automatic sensor lighting controls, no dimming, no light reduction controls. ON/OFF with Hubbell key switches located at main entry/exit door and as directed by CFISD. Provide manual DLM switch for ON/OFF control in swimming coaches' office or other supervised location as directed by CFISD. The DLM room controller for the natatorium shall be located above an accessible low height ceiling, preferably next to the coaches' office DLM room controller, or as directed by CFISD.
- D. CAFETERIA, CAFETORIUM, GYMS, LIBRARY, STAGE, LOCKER ROOMS
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights OFF. No occupant sensors for safety and security. Local

- DLM switches also function as a local DLM override. Dimming only as required for light reduction, code required daylight harvesting, and as indicated on drawings.
2. Cafeterias and cafetorium's: DLM Hubbell SPDT key switches at cafetorium main entry. Dimming switches at main entry and on stage. Cafeterias require only one dimming zone. Cafetorium with stage: Provide up to three dimming zones, zoned from front of house to back of house.
  3. School stage general lighting: General lighting for stages and platforms with proscenium curtains or wall dividers shall be controlled as a separate zone. Provide a separate zone for back-of-house stage access ramps. Provide DLM ON/OFF control for the stage general lighting at each entry/exit point to the stage. Provide ramp lighting ON/OFF DLM control at each end of the ramp. Verify zoning and switch locations with theatrical consultant drawings.
  4. Elementary School Cafetorium Theatrical Track Lighting: Locate four ganged wall box 120-volt line voltage dimmer controls on stage at an accessible location, not obstructed by stage curtains, as indicated or as directed by CFISD.
  5. Library: Manual DLM control located in supervised area (behind circulation desk or as directed by CFISD). Hubbell SPDT key switch at main entry door location as directed by CFISD. If dimming zones are provided locate dimming controls in a secured area (circulation desk). Key switch ON function shall force all lights to full bright.
  6. Gyms: Manual DLM Hubbell SPDT key switch. Provide separate zones with Hubbell key switch to enable UIL competition light level for UIL Sports Lighting Standards. Label key switch for UIL competition light level control as court as "UIL COMPETITION ONLY".
  7. Locker rooms: Occupancy sensors control for auto ON/OFF: Set sensors to full-bright on and 20-minute time delay off for safety and security. Manual ON/OFF with DLM Hubbell momentary SPDT key switches located at main entry doors and as directed by CFISD. Provide lighting in these areas with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls.

- E. CLOSED-DOOR ADMINISTRATIVE OR PRIVATE TOILETS/RESTROOMS, DRESSING ROOMS, OTHER TOILETS/RESTROOMS WITH DOORS NOT DIRECTLY CONNECTED TO A CORRIDOR:
1. SEQUENCE: Occupancy sensors (DLM system manual ON/OFF, automatic ON/OFF).
  2. Provide dual technology occupancy sensor control for automatic ON/OFF based on occupancy. Set occupancy time delay and sensitivity to device setting maximum for safety and security.
  3. Student/public restrooms with doors not connected to an adjacent egress corridor: Provide CFISD standard Hubbell momentary key switch at student and public toilets/restrooms entry door location for manual DLM ON/OFF.
  4. Private or administrative toilets/restrooms: Provide standard DLM ON/OFF switch for all other restrooms and dressing rooms with doors.
- F. MECHANICAL, ELECTRICAL, PLUMBING, ELEVATOR, AND TECHNOLOGY ROOMS
1. Provide line voltage mechanical time switch withhold at each entry door, wired in parallel as required. Refer to Line Voltage Wiring Device specifications.
- G. CUSTODIAL, JANITORIAL, STORAGE LESS THAN 100SF, UTILITY ROOMS, FREE STANDING REMOTE BUILDINGS (CONCESSION, PRESS BOX, TICKETING, ETC.)
1. DLM vacancy sensor, no dimming except for press box viewing space.
- H. BLACK BOX THEATRES
1. Black box theatres shall be provided with standalone instructional lighting, lighting controls and emergency lighting typical of instructional areas and classrooms.

### 3.4 IDENTIFICATION FOR LIGHTING CONTROL SYSTEM EQUIPMENT

- A. Above ceiling lighting control system equipment locators: Provide plastic tape machine typed name plate to bottom of ceiling T-grid below relay location. White letters on black background with ¼" high letters on ½" tall label for digital lighting module indicate as: DLM.
- B. Room controller identification: Label each digital room controller with 120/277 Volt circuit (i.e., "HD-27") and room graphic name and number. Do not use architectural room name or number on



drawings, use room graphic identification only.

- C. All low voltage wiring shall have "WattStopper" printed on the wire jacket.

### 3.5 ATTIC STOCK

- A. Provide a minimum of 2 or 5 percent of the project total, whichever is greater, of all other hardware components used.
- B. Provide five configuration handheld remote tools for new facilities or three remote configuration handheld remote tools for renovation facilities.

### 3.6 FACTORY COMMISSIONING

- A. The installing electrical contractor shall complete, prior to request of WattStopper factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed and confirmed operation of each and every local room network. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
- B. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning. Drawing shall include room by room device ID's and locations of all WattStopper devices.
- C. The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete working system.
- D. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
  - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - 2. Sequence of operation, (e.g., manual ON, Auto OFF. etc.)
  - 3. Load Parameters (e.g., blink warning, etc.)
- E. The electrical contractor shall provide in writing, both the manufacturer and Owner, with 21-Owner business days written notice of the requested system startup and adjustment date.
- F. The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.
- G. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the Owner's personnel on the adjustment and maintenance of the system.
- H. Re-commissioning – After 90 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.
- I. Close-out commissioning - After 11-months from substantial completion, re-calibrate sensor time delays and sensitivities to Owner's Satisfaction at no additional cost to the Owner. Provide a detailed report to the Architect / Owner of re-commissioning activity.

END OF SECTION 26 09 28

SECTION 26 12 17

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Copper-wound three-phase transformer exceeding US Department of Energy 2016 Efficiency Standards, with extremely low no load losses.
  - 1. Transformers shall be designed to an efficiency standard higher than NEMA Premium.
- B. Load Mix: Transformer shall be UL 1561 Listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.2 REFERENCES

- A. FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 431. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; 2016 Standards
- B. DOE Test Method For Measuring The Energy Consumption Of Distribution Transformers Under Appendix A To Subpart K Of 10 CFR Part 431.
- C. Metering Standards:
  - 1. Computational algorithms per IEEE Std 1459-2000
  - 2. UL 916, UL 61010C-1 CAT III
- D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
  - 1. IEEE Standard 1100 documents how typical transformers feeding electronic equipment produce substantially higher losses under electronic equipment load compared to under linear load, requiring derating.
- E. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.
- F. ISO 9000:2000 – International Standards Organization - Quality Management System
- G. ISO 14000:2004 – International Standards Organization - Environmental Management System
- H. NFPA 70 - National Electrical Code (Latest Edition)
- I. NEMA ST20-2014 - Dry-Type Transformers for General Applications
- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment
- K. US Department of Energy, 10 CFR Part 431, 2015. Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule.
- L. IEEE C57.110-2008 – IEEE Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.
- M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories.
- N. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

- A. Submit product data including the following:
  - 1. Copy of ISO 14001:2004 Certification of manufacturing operation.
  - 2. Copy of ISO 9001:2000 Certification of manufacturing operation.
  - 3. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
  - 4. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight
  - 5. Inrush Current (typical 3 cycle recovery)
  - 6. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)
  - 7. Efficiency Data
    - a. No load and full load losses per NEMA ST20
    - b. Linear load Efficiency data @ 1/6 load
    - c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
    - d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
    - e. Efficiency under specified K rating load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
  - 8. Copy of Factory ISO 9001 documentation describing nonlinear load test program
    - a. Meter and CT details including model, accuracy, serial numbers and calibration information.
  - 9. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer
  - 10. 25 year Product Warranty Certificate
- B. Description of manufacturer's factory nonlinear load test program.
  - 1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.
  - 2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.
  - 3. The nonlinear load bank shall consist of a phase-neutral loading with a specified K rating load profile, representative of a mix of typical commercial equipment.
  - 4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.
  - 5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.
  - 6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
  - 7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

#### 1.4 SPECIFICATION COMPLIANCE REVIEW

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store and protect products
- B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out

#### ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

dust, water and other foreign material.

- C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

#### 1.6 WARRANTY

- A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product line.

#### 1.7 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING PLANT

- A. Registration to current ISO standard is required.
- B. Independent annual audits are conducted.
- C. Product shall be manufactured in registered facility
- D. ISO 9001:2000 Registered – Quality Management System
- E. ISO 14001:2004 Registered – Environmental Management System
  - 1. Transformer manufacturing can produce significant emissions of volatile compounds and significant other waste. To minimize environmental impact, the transformer must be the product of a manufacturing process that has been independently audited to comply with the ISO 14001:2004 Environmental Management System Standard, where strict quality control of raw material sourcing and construction techniques maximize product efficiency and minimize emissions and waste byproducts.
  - 2. ISO 14001:2004 ensures that a facility has had an independent environmental impact assessment of raw material sourcing and all manufacturing processes, and has implemented an independent annually audited program that minimizes environmental impact during manufacturing process and includes a strictly monitored continuous improvement program.

### PART 2 – PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

- A. Powersmiths E-Saver OPAL
- B. Power Quality International (Z3 e-Rated)
- C. Mirus - ULLTRA

#### 2.2 TRANSFORMER SPECIFICATION

- A. Minimum UL Listed and Labeled K-Rating: K7
- B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers 750 kVA and less, 600 volt primary and less, shall be UL Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.
- C. Insulation System:
  - 1. Shall be NOMEX-based with an Epoxy Co-polymer impregnate for lowest environmental impact, long term reliability and long life expectancy
    - a. Class: 220 degrees C
    - b. Impregnate Properties for low emissions during manufacturing, highest reliability and life expectancy

### ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

- c. Epoxy co-polymer
  - d. VOC: less than 1.65 lbs./gal (low emissions during manufacturing)
  - e. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)
  - f. Chemical Resistance: Must have documented excellent performance rating by supplier
  - g. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress, overvoltage tolerance)
  - h. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life
- D. Operating Temperature Rise: Maximum 115 degree C in a 40 degree C maximum ambient
- E. Noise levels:
- 1. 3dB Below NEMA ST-20
  - 2. Production Test every unit. Data to be available upon request.
- F. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431, April 18, 2013, Energy Conservation Program: Energy Conservation Standards for Distribution Transformers: Final Rule which takes effect January 1, 2016, and comply with the table of maximum no Load Losses, efficiency requirements at 1/6 load, efficiency at 35% load per 10 CFR Part 431, and efficiency at 25% load under the transformer specified K-rating load profile.
- G. Maximum losses and minimum efficiency under linear load conditions per Table 1.

<p>Table 1 Max and Min Values for Losses and Efficiency for "High Efficiency" Transformers Under K1 Linear and Specified K-Rating Nonlinear Loading</p>													
kVA Rating	No Load	16.5% Load				25% Load				35% Load			
		K1 Linear		Nonlinear		Linear		Nonlinear		K1 Linear		Nonlinear	
	Max Loss (kW)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)
15	0.054	0.066	97.38	0.067	97.36	0.082	97.86	0.085	97.78	0.109	97.97	0.117	97.82
30	0.091	0.112	97.79	0.113	97.77	0.138	98.19	0.144	98.12	0.183	98.29	0.200	98.13
45	0.124	0.152	98.00	0.154	97.97	0.187	98.36	0.197	98.28	0.248	98.45	0.276	98.28
75	0.181	0.221	98.24	0.225	98.22	0.273	98.56	0.288	98.49	0.362	98.64	0.404	98.48
112.5	0.245	0.300	98.41	0.305	98.38	0.370	98.70	0.393	98.62	0.490	98.77	0.555	98.61
150	0.303	0.370	98.53	0.377	98.50	0.457	98.80	0.486	98.72	0.605	98.86	0.688	98.71
225	0.410	0.501	98.67	0.510	98.64	0.619	98.91	0.659	98.84	0.820	98.97	0.937	98.82
300	0.509	0.622	98.76	0.636	98.73	0.769	98.99	0.829	98.91	1.018	99.04	1.194	98.88
500	0.741	0.906	98.91	0.928	98.89	1.119	99.11	1.213	99.04	1.482	99.16	1.754	99.01

- H. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

- I. Impedance: Between 3.0% and 6.0% unless otherwise noted.
- J. Enclosure type: Ventilated NEMA 2; NEMA 3RX aluminum or stainless steel when located outdoors, or as indicated otherwise
- K. Finish Color: Provide light gray ANSI-61 paint finish for transformers located outdoors. Provide manufacturer's standard paint finish color indoors.
- L. Transformer Options:
  - 1. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield
- M. Closed delta 120/240-Volt secondary, 3-phase, 4-wire with center tap neutral winding transformers:
  - 1. KVA rating indicated shall be for balanced 3-phase loading. Center tap winding shall allow for a maximum nominal 70-percent of three-phase kVA rating for unbalanced single phase neutral connected 120/240-Volt loads. The center tap winding shall be individually rated or constructed at twice the capacity of each of the other delta connected windings. (Example: a 225kVA rated center tap transformer would consist of two 75-kVA windings and one 150-kVA center tap winding).

### PART 3 – EXECUTION

#### 3.1 INSTALLATION

- A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.
- B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces.
- C. Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.
- D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.
- E. Check for damage and loose connections.
- F. Set the transformer plumb and level.
- G. Provide Seismic restraints where required.
- H. Coordinate all work in this Section with that in other sections.
- I. Verify all dimensions in the field.
- J. Adjust transformer secondary voltages to provide the required voltage at the loads.

#### 3.2 TESTING

### ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

- A. Insulation Tests: Before energizing, check transformer windings for continuity.
- B. Winding Current: During initial no-load energizing, check current in each primary winding.
- C. Tap Settings: Measure and record load current and voltage of transformers while loaded to verify proper transformer tap settings.
- D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.
- E. Performance Validation: To ensure that the products shipped to the job site meet this specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as selected by customer. Submit a detailed report to the project engineer.
- F. Identify non-compliant products to the engineer and replace at no cost to the Owner.
- G. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION

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SWITCHBOARDS

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard work as shown, scheduled, indicated, required, and specified.

1.2 QUALITY ASSURANCE

- A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

- A. Indicate:
  - 1. Detailed dimensions for equipment foot print, front and side elevations.
  - 2. Conduit entrance locations and requirements and restrictions.
  - 3. Enclosure material, finish, and NEMA classification type.
  - 4. Nameplate legends.
  - 5. Size and number of bus bars
  - 6. Switchboard instrument details.
  - 7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB General Electric Co.
- C. Siemens

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide switchboard manufacturer's materials and components as indicated and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS

- A. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- B. Provide a factory-assembled, dead-front construction, metal enclosed, self supporting, switchboard of voltage, phase, ampacity, and short circuit interrupting rating and bracing shown.
  - 1. Switchboard shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid switchboard. The switchboard shall be designed as a free-standing with only front access. Rear and/or side access only where

SWITCHBOARDS

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- indicated to reduce switchboard depth and where NEC required rear access clearance is available.
2. Switchboard shall include protective devices and equipment shown with interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks in the switchboard shall be provided. Groups of control wires leaving the switchboard shall be furnished with terminal blocks with numbering strips.
  3. Factory installed permanent lock-off provision for pad-locking in the off position for all protective devices.
- C. Enclosure Construction: The switchboard framework shall be fabricated for floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices.
1. Each section shall have an open bottom and individually removable top plates for installation and termination of conduit. Top and bottom conduit areas shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and with flexibility at the hinged side. Closure plates shall be screw removable and small enough for easy handling by one technician.
  2. Weatherproof enclosure front door(s) shall be pad-lockable and suitable for the intended environmental conditions. When indicated or specified, rear doors shall also be pad-lockable.
- D. Busing: The switchboard busing shall be copper.
1. The bus bars shall be braced to comply with the integrated equipment rating of the switchboard. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit entry area. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, so as not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per phase. Half lapped bus joint construction is not acceptable.
  2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the switchboard.
  3. The main horizontal bus and incoming line shall be isolated and insulated from outgoing busing and cable connections.
  4. Each group mounted section shall have maximum full height bus. Where space is indicated, space shall be bused to install future switches or future circuit breakers sized as shown or a 600 Amp frame size circuit breaker or switch, whichever is greater.
  5. The main horizontal bus shall be non-tapered, fully rated, extended and drilled for future additions and splice plates.
- E. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment can withstand the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.
- F. Indicating Instruments: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:
1. Voltmeter, phase to phase and phase to ground or neutral.
  2. Current, per phase RMS and 3 phase coverage.
  3. Demand current per phase.
  4. Power factor per phase and 3 phase average.
  5. Real power, 3 phase total.
  6. Reactive power, 3 phase total.
  7. Apparent power, 3 phase total.
  8. Frequency.
  9. Average demand real power.
  10. Adjustable demand interval (5 to 60 minutes).
  11. Nonvolatile memory.
  12. Password protected set-up and reset.

13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
  14. Full scale readouts with the following accuracy:
    - a. Current and voltage measurement +/-0.1%
    - b. Power and energy +/-0.2%
    - c. Frequency +/-0.5%
    - d. Power Factor +/-1.0%
    - e. Data update time 0.5 seconds (4 wire)
  15. Metering Output.
    - a. Pulse output based on kWh, kvarh, or kVAh.
    - b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
  16. Monitoring:
    - a. Harmonic analysis through 63<sup>rd</sup> with THD and TIF.
    - b. Event recorder.
    - c. Waveform capture.
    - d. Data logger.
    - e. Triggered trace memory.
  17. Communication:
    - a. Front port and dual rear mounted RS485 ports.
    - b. BACnet protocol (coordinate with BMCS contractor).
    - c. Mini RTU: digital 4 in/4 out.
    - d. Analog 1 in/4 out.
    - e. Local/remote display of all values.
  18. Software:
    - a. Windows based software shall be provided to enable setpoint programming.
- G. The Main Protective Device(s) shall be individually mounted molded case circuit breaker(s):
1. Adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state true RMS sensing, without fusible elements, 100-percent continuous current rating.
  2. Main protective devices with frame rated at 1000 Amps or greater shall have integral ground fault interrupter and provided with a portable test set or test switch.
  3. Circuit breakers with 1,200 Amp frame and above shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
  4. Provide shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
- H. Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
    - a. Adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
    - b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
    - c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
  2. Fusible switches:
    - a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
    - b. Fused switches 600 Amps and below, equipped for class J fuses.
    - c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
    - d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- I. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
1. Molded case circuit breakers:
    - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip; 80-

- percent continuous current rating.
    - b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
    - c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
  - 2. Fusible switches:
    - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
    - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
    - c. 600 Amps and below equipped for Class J fuses.
    - d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
    - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- J. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
  - 1. Ground fault protection shall be set at minimum setting for both current and time during construction. The switchboard manufacturer shall include in the submittal data for the switchboard, the minimum setting of the devices and the recommended setting for normal building operation.
  - 2. The ground fault system shall be factory-tested before shipment as specified:
    - a. The switchboard manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
    - b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
    - c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.
- K. Mimic bus: Indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips, fastened flat against the panel face with screws.

## PART 3 – EXECUTION

### 3.1 INSTALLATION OF SWITCHBOARDS

- A. Install switchboards where shown, in accordance with the manufacturer's written instructions, and industry practices to ensure that the switchboards meet the specifications. Provide weatherproof NEMA 3R enclosure housing outdoors, at wet locations, or where indicated on the drawings. Provide NEMA 3RX enclosure housing at corrosive locations of either aluminum or stainless-steel construction suitable for the intended environment when indicated on the drawings.
- B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.
- C. Where switchboard is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the switchboard.

- D. Torque bus connections and tighten mechanical fasteners.
- E. Install fuses, of ratings shown, in each switchboard. Provide spare fuse cabinet with three fuses of each size provided. Locate in central plant as directed by Owner.
- F. Concrete Pads: Install switchboards on a 4" reinforced concrete housekeeping pad. The housekeeping pad shall extend 3" beyond the housing of the switchboard unless shown otherwise. Switchboard shall be bolted to the housekeeping pad using 3/8" minimum galvanized bolts and anchors on 30" maximum centers. Furnish the exact position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.
- G. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as recommended by the Fault Current and Coordination Analysis or as directed by the Engineer.
- H. Indicating Instruments: Provide initial factory start-up and programming with Owner present. Integrate with the Building Management System for monitoring and logging of all system data.

### 3.2 TESTING

- A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so that the CxA may witness tests at the CxA's discretion.
- B. Pre-energization checks: Before energizing, check switchboards for continuous of circuits and for short circuits.
- C. Switchboard insulation resistance test: Each switchboard bus shall be insulation resistance tested after installation is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.
- D. Ground Fault Interrupter (GFI) test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50 percent of overcurrent device rating or 1,200 Amperes, whichever is lower.
- E. Provide thermal infrared scan of switchboard under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out.
- F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

### 3.3 TRAINING

- A. Provide minimum 2 hours of dedicated training provided by a factory authorized representative to Owner's personnel regarding programming, operating, and use of switchboard components including all indicating instruments and safety features.

END OF SECTION



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TESTING, MAINTENANCE, AND MODIFICATIONS TO EXISTING SWITCHBOARDS  
AND FEEDER DISTRIBUTION PANELBOARDS

PART 1 -GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard and distribution panel work to existing switchboards or distribution panelboards 800 Amps or more and 600 volts or less as shown, scheduled, indicated, and specified.
- B. Types: Work for the project includes switchboards and feeder distribution panelboards.

1.2 QUALITY ASSURANCE

- A. Original Equipment Manufacturer's (OEM's) Installation and Maintenance Instructions. Coordinate with the OEM's field service representative for specific recommendations for the equipment involved prior to evaluation, testing, and maintenance procedures.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB1 "Panelboards", and Standard PB2, "Dead-Front Distribution Switchboards."
- C. Testing shall be performed by the OEM an InterNational Electrical Testing Association (NETA) National Accredited Company (NAC) and by NETA Certified Technicians with the appropriate NETA level of certification for the testing required.

1.3 SUBMITTALS

- A. Indicate Original Manufacturer's Installation and Maintenance Instructions for testing, exercising, cleaning, and lubrication where available.
- B. Include electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time current curves of all equipment and components.
- C. Original Manufacturer's Inspection Report when available.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Replacement parts shall be manufactured by Original Equipment Manufacturer, (OEM) when available. When OEM parts are not available, third party, UL recognized, manufactured parts may be used. Provide written confirmation on Manufacturer's letterhead indicating OEM parts are not available.

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed, and constructed as recommended, and as required for a complete installation.

2.3 NEW OVERCURRENT DEVICES AND/OR NEW ACCESSORIES

- A. New Indicating Instruments where indicated: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:
  - 1. Voltmeter, phase to phase and phase to ground or neutral.
  - 2. Current, per phase RMS and 3 phase coverage.
  - 3. Demand current per phase.
  - 4. Power factor per phase and 3 phase average.

TESTING, MAINTENANCE, AND MODIFICATIONS TO EXISTING SWITCHBOARDS  
AND FEEDER DISTRIBUTION PANELBOARDS

5. Real power, 3 phase total.
  6. Reactive power, 3 phase total.
  7. Apparent power, 3 phase total.
  8. Frequency.
  9. Average demand real power.
  10. Adjustable demand interval (5 to 60 minutes).
  11. Nonvolatile memory.
  12. Password protected set-up and reset.
  13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
  14. Full scale readouts with the following accuracy:
    - a. Current and voltage measurement +/-0.1%
    - b. Power and energy +/-0.2%
    - c. Frequency +/-0.5%
    - d. Power Factor +/-1.0%
    - e. Data update time 0.5 seconds(4 wire)
  15. Metering Output.
    - a. Pulse output based on kWh, kvarh, or kVAh.
    - b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
  16. Monitoring:
    - a. Harmonic analysis through 63<sup>rd</sup> with THD and TIF.
    - b. Event recorder.
    - c. Waveform capture.
    - d. Data logger.
    - e. Triggered trace memory.
  17. Communication:
    - a. Front port and dual rear mounted RS485 ports.
    - b. BACnet protocol (coordinate with BMCS contractor).
    - c. Mini RTU: digital 4 in/4 out.
    - d. Analog 1 in/4 out.
    - e. Local/remote display of all values.
  18. Software:
    - a. Windows based software shall be provided to enable setpoint programming.
- B. New Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
    - a. Adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
    - b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
    - c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
  2. Fusible switches:
    - a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
    - b. Fused switches 600 Amps and below, equipped for class J fuses.
    - c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
    - d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- C. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
1. Molded case circuit breakers:
    - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
    - b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by

TESTING, MAINTENANCE, AND MODIFICATIONS TO EXISTING SWITCHBOARDS  
AND FEEDER DISTRIBUTION PANELBOARDS

- rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
- c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- 2. Fusible switches:
  - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
  - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
  - c. 600 Amps and below equipped for Class J fuses.
  - d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
  - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, MAINTENANCE, AND MODIFICATION OF SWITCHBOARDS AND FEEDER DISTRIBUTION PANELBOARDS

- A. Comply with the requirements of NEMA, NEC, and NECA Standards for installation, for installation of switchboards and panelboards. Comply with Original Manufacturer's Operation and Maintenance Instructions for testing and periodic maintenance.
- B. Torque all existing and new bus connections and tighten mechanical fasteners to manufacturer's specifications.
- C. Install fuses, of ratings shown, in each new or modified fused switch.
- D. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as directed by the OEM for coordination with downstream overcurrent devices.
- E. Existing Indicating Instruments: Test and calibrate to original manufacturer's specifications. Replace batteries in existing digital instruments where batteries are required. Replace defective indicating instruments with new digital instruments. Provide new digital indicating instruments where indicated on the drawings.
- F. Cleaning: Vacuum the interior of the existing enclosures of all dust and foreign matter. Clean all existing switch contacts according to manufacturer's instructions.
- G. Lubrication: Lubricate all existing exposed switch contacts, pivot points and bearings according to manufacturer's instructions.
- H. Remove any existing circuit breakers or fusible switches that are not functional or not suitable to be reused as "spares".
- I. Provide filler plates where required.
- J. Existing enclosures which indicate rust or corrosion shall be repainted; paint indoor non-stainless steel enclosures with ALKYD enamel coat, and outdoor non-stainless steel enclosures with epoxy enamel coat to match existing color. Do not paint over labels or listings.
- K. Mimic bus: Update the existing mimic bus or provide new mimic bus to indicate busing, connections, and devices in single line form on the fronts of switchboards. Use red colored plastic strips or match exiting material and color format, fastened flat against the panel face with screws.

#### 3.2 TESTING

- A. Provide the services of a NETA NAC or Original Manufacturer's Field Services personnel for initial

#### TESTING, MAINTENANCE, AND MODIFICATIONS TO EXISTING SWITCHBOARDS AND FEEDER DISTRIBUTION PANELBOARDS



testing at no additional cost to the Owner. The NETA NAC or Original Manufacturer's Field Services personnel shall provide at minimum, a visual inspection of the existing switchboards or panelboard and shall provide a written report with recommendations regarding the existing condition and recommendations to further testing, maintenance, and in regard to the specified modifications of the existing switchboard or panelboard. The report shall include any deficiencies of the existing switchboard in relation to each component's intended function. In addition, provide deficiencies of the existing switchboard or panelboard with regard to the current National Electrical Code. Provide the written report to the Architect within 14 days of notice to proceed and prior to any demolition or construction. All other testing, maintenance, and modifications shall be provided by the Contractor as specified at no additional cost to the Owner.

- B. Pre-Energization Checks: Before energizing, check for continuous of circuits and for short circuits. Test existing Bolted Pressure Switches according to Original Manufacture's Instructions.
- C. Insulation Resistance Test: Each bus shall be insulation resistance tested after installation and modification is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.
- D. Ground Fault Protection System Test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's recommended settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 1,200 Amps or 50-percent of the circuit breaker or fused switch frame size, whichever is lowest.
- E. All circuit breakers with adjustable trip settings shall fully tested to verify all fixed and adjustable overcurrent and ground fault trip settings are set to the proper setting and function within manufacture's recommended tolerances.
- F. Provide thermal infrared scan of the under full load prior to testing/maintenance and modifications and of the modified or new equipment sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to close out and make corrections prior to close-out. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.
- G. Submittals: Furnish instruments and certified personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include project location, testing contractor and testing technician's contact information, equipment tested, date and time of test, relative humidity, temperature, and weather conditions.

END OF SECTION

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PANELBOARDS AND ENCLOSURES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

1.3 SUBMITTALS

- A. Indicate:
1. Detailed dimensions.
  2. Enclosure material, finish, and NEMA classification type.
  3. Location of main circuit breaker.
  4. Mounting and trim.
  5. Acceptable incoming conductors' size.
  6. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, bus material and rating, withstand ratings, lugs, and time current curves of all overcurrent devices and components.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens

2.2 MATERIALS AND COMPONENTS

- A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.
- B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.
- D. Main circuit breakers and feeder / branch circuit breakers:
1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
  2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with

PANELBOARDS AND ENCLOSURES

- short time tracking.
- 3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set by rating plug or adjustable dial, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
- 4. Provide permanent lock-off device for all fire alarm system branch circuit breakers, for all smoke control fans and equipment, and where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
- 5. General requirements:
  - a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
  - b. Two and three pole breakers shall have internal common trips.
  - c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.
  - d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.
  - e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).
  - f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
  - g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.
  - h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).
- E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.
- F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.
- G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.
- H. GFCI circuit breakers not available in the required panel AIC rating shall be series rated with the upstream over current protection device to provide the panelboard with required AIC rating. Coordinate series rating requirements with manufacturer. Mark the panel per NEC 110. The marking shall be visible and state the following: "CAUTION-ENGINEERED SERIES COMBINATION SYSTEM RATED XXX AMPERS. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED".
- I. Panelboard Enclosures:
  - 1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner's standard key system; coordinate with Owner.
  - 2. All NEMA 1 enclosure panelboards shall be hinged "door-in-door" type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push

inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not use third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.

3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
7. Enclosure shall be for recessed or surface mounting as shown or as required.
8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

## PART 3 – EXECUTION

### 3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

- A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.
- B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).
- E. Fuses: Install fuses, of the ratings and class shown.
- F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.
- G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.
- H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as "not used" and include panel identification.
  1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box from each panelboard section.
  2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.
- I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.

## PANELBOARDS AND ENCLOSURES

- J. Circuit breakers and conductors installed for SPD devices shall be located on the same side as the SPD to allow the shortest and straightest run of conductors in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.
- K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.
- L. Install panels so that breaker number 1 is the top left breaker.
- M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.
- N. Label breaker mounting space with stick-on number labels.
- O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.

### 3.2 TESTING

- A. Before energizing, energization, check for continuity of circuits and short circuits.
- B. Provide thermal infrared scan of panelboards under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout and make corrections prior to close-out.

END OF SECTION

SECTION 26 24 25

ENCLOSED SWITCHES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.
- B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens

2.2 ENCLOSED SWITCHES

- A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horsepower served.
- B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Switch Mechanism:
  - 1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
  - 2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.
- D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.
- E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch.

2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

ENCLOSED SWITCHES

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- A. Overcurrent protective devices 1,200 Amps and below:
  - 1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
  - 2. Molded case circuit breakers:
    - a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
    - b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
    - c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
  - 3. Fusible switches:
    - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
    - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
    - c. 600 Amps and below equipped for Class J fuses.
    - d. 601 Amps and above shall be equipped for Class R or L fuses.
    - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
  - 1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
  - 2. The ground fault system shall be factory-tested before shipment as specified:
    - a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
    - b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
    - c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

## 2.4 ENCLOSURES

- A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.
- B. Enclosures in exterior locations shall be NEMA 4X stainless steel.
- C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and

industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.

- B. Location: Provide safety switches within 50' and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).
- C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.
- D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.
- E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.
- F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: "WARNING" (1/2 Inch Letters). "TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE." (1/4 inch letters).
- G. Provide disconnect switch for electric duct heaters.
- H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.
- I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch, coordinate with Division 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system to monitor all disconnect switches open/closed position that serve the smoke control system. All fire alarm and control wiring directly related to the monitoring of the supply power disconnect switches and control of the smoke control fans shall be installed in conduit.

### 3.2 TESTING

- A. General: Before energizing, check for continuity of circuits and short circuits.
- B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION





SECTION 26 24 30

FUSES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Fuse work as shown and scheduled, and as specified.
- B. Types: Fuses required for the project include the following:
  - 1. 250 volt current limiting fuses
  - 2. 600 volt current limiting fuses

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

- A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.
- B. Types:
  - 1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
  - 2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
  - 3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
  - 4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

- A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.
- B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION



SECTION 26 27 73

LINE VOLTAGE WIRING DEVICES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

- A. UL Label: Wiring devices shall be UL labeled.
- B. NEMA Standard WD1 and WD6.
- C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.
- B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277- Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.
- C. Submit manufacturer's product data sheet for each style of device and plate on the project.
- D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toggle switches, straight blade and twist lock devices, interior cover plates. Devices with manufacturer provided pig tails or plug-in pig tail are prohibited:
  - 1. Leviton
  - 2. Hubbell
  - 3. Pass and Seymour
- B. Dimming
  - 1. Leviton
  - 2. Lutron

2.2 WIRING DEVICE COLOR

- A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source and located in mechanical, electrical, or technology rooms shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in

LINE VOLTAGE WIRING DEVICES

color where the building standard color is not available. All wiring devices supplied from an emergency source located in other than mechanical, electrical, or technology rooms shall be gray.

- B. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

## 2.3 RECEPTACLES

- A. Industrial grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, back and side wired with screw type terminals, NEMA indicated, (X=color designation).
1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
  2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
  3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
  4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
  5. 20A, 125V plug load control, split circuit marked for "controlled", tamper resistant: Leviton #TDR20-S1G
  6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX
- B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
  2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.
- C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated. Hospital grade devices are required for all audio/visual system equipment outlets, refer to Specification Section 27 41 00 Performance and Broadcast Audio/Video Systems for more information.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
  2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (Orange color devices)
  3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
  4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX

## 2.4 WALL SWITCHES

- A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
  2. Double pole 120/277V, 20A switch: Leviton #1222-2X
  3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
  4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
  5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
  6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G
- B. Toggle key operated switch (verify manufacture and key type with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Hubbell HBL #1221GY
  2. Two-pole, 120/277, 20A key operated, Hubbell HBL #1222GY
  3. Three-way, 120/277V, 20A key operated switch: Hubbell HBL #1223GY
  4. Four-way, 120/277V, 20A key operated switch: Hubbell HBL #1224GY
  5. Momentary, single pole double throw, center off, 20A key switch: Hubbell #HBL 1557LG
  6. Key: Hubbell #HBL 1209. Key switches shall be keyed alike to match the Owner's standard key system. Coordinate with Owner.

## LINE VOLTAGE WIRING DEVICES

## 2.5 WALL DIMMERS

- A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
  2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
  3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
  4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
  5. Color change kit as required.

## 2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

- A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GGBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: VENDING MACHINE GFCI).

## 2.7 INTERIOR WALL COVER PLATES AND FASTENERS

- A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).
- B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
1. Provide laser cover plate engraving with black filling for all wiring devices indicating panelboard name, circuit, and voltage.
  2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word "EMERGENCY" in black.
  3. Text orientation shall be upright, readable from left to right when cover plate is installed.
  4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
  5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream ("RM RECEPES", "HOOD RECEPES", "VENDING", "REFRIG", etc.) For other loads, Owner/Architect shall determine name plate wording.

## 2.8 EXTERIOR COVER PLATES

- A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
1. Vertical mount receptacle: #CKSUUV
  2. Horizontal mount receptacle: #CKMU
  3. Two-gang: #2CKU
  4. 30-60 Amp Devices: #CKLSUV

## 2.9 CORD REELS AND DROP CORDS

- A. Cord Reels:
1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
  2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
  3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
  4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.

5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.
- B. Drop cord receptacles:
  1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
  2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
  3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
  1. Key switches and keys shall be as specified and also as approved by Owner.
  2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.
- B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.
- C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.
- D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.
- E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.
- F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.
- G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.
- H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.
- I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.
- J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.
- K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)
- L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.

- M. Do not share neutral conductor on load side of dimming switches.
- N. Install receptacles with grounding pole down, or as directed by Owner only for equipment with a corded plug that requires a different orientation (i.e., flat plug assembly), to ensure cord remains plugged and cord hangs down tight against wall. If installed horizontally, install with neutral pole on top.
- O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- P. Provide field installed pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by the manufacturer.
- Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.
- R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.
- S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.
- T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

### 3.2 GROUND FAULT PROTECTION FOR PERSONELL

- A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.
- B. GFCI personal protection locations include but are not limited to the following:
  - 1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.
  - 2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following locations indicated below.
  - 3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
    - a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
    - b. Bathrooms/toilets/restrooms
    - c. Janitors/custodial closets and mop sinks.
    - d. Laundry areas
    - e. Parking structures, service garages, garages and accessory buildings
    - f. Basements, crawl spaces (including 120-Volt lighting)



- g. Within 6-feet of all water sources including sinks, mop-sinks, lavatories, bathtubs, shower stalls, faucets, eye wash stations, emergency shower stations
  - h. Indoor damp and wet locations
  - i. Locker rooms
  - j. Indoor swimming pools and natatoriums areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
  - k. Non-dwelling unit therapeutic tubs/pools/whirlpool areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
  - l. Receptacles serving dwelling unit kitchen counter tops
  - m. Vending machines
  - n. Elevators, dumb waiters, escalators, moving sidewalks: receptacles in pits, hoist ways, well ways or those mounted on the cars of elevators and dumb waiters.
  - o. Electric vehicle charging equipment.
  - p. All receptacles serving kitchen or food preparation counter tops.
  - q. Automotive vacuum machines
  - r. Drinking water fountains/coolers and bottle fill stations
  - s. Corded high-pressure spray washing machines
  - t. Tire inflation machines
  - u. Dish washers
  - v. Receptacles at end of cord reels or drop cords.
  - w. Boat houses, boat hoist, and all pier/dock receptacles and lighting (excludes shore power that requires GFPE).
  - x. Central plant, mechanical rooms and electrical rooms
  - y. Wood, metal, or other material fabrication or vocational training shops.
  - z. Receptacles that serve educational science and science prep room counter tops.
- C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine, refrigerators or other equipment, provide remote GFCI blank face in same room as protected receptacle and at a readily accessible location with standard receptacle outlet behind equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power cord distance from the edge of a sink to the surface of the refrigerator.
- D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height as light switches or ganged with the light switch. Provide GFCI protection for all receptacle outlets located below 42-inches in all infant through 2-year old day care and similar areas designated for occupancy by infant through 2-year old day care occupants so the GFCI device can easily be intentionally tripped or tested and reset.
- E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for utilization equipment as required by the NEC and where indicated on the drawings.
- 3.3 PERFORMANCE AND BROADCAST AUDIO VISUAL SYSTEMS RECEPTACLES
- A. All 125-Volt receptacles providing power to A/V systems from dedicated A/V power transformers shall be hospital grade, isolated ground type receptacles. The isolated ground conductor connection shall be in addition to the solid green raceway/box grounding conductor.
- 3.4 TESTING
- A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.
- B. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization, voltage and phase orientation if intended 3-phase equipment is phase orientation dependent for proper motor rotation or operation.
- C. Test each individual GFCI receptacle and all downstream receptacles protected by an upstream GFCI device with simulated ground fault tester, make corrections as necessary.
- D. Operate each wall switch with circuit energized and verify proper operation.
- 3.5 ATTIC STOCK

- A. For each type of wiring device cover plate requiring the word "EMERGENCY", provide attic stock of 20 cover plates of each type (simplex, duplex, triplex, etc.).

END OF SECTION



SECTION 26 43 00

SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Surge Protection Device (SPD) covered under this section includes service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 5<sup>th</sup> Edition, applied to the line or load side of the utility feed inside the facility. SPDs shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.
- B. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

- A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
  - 1. UL 1449 Fifth Edition
  - 2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
  - 3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
  - 4. IEEE 1100 Emerald Book.
  - 5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
  - 6. UL 1283 – Electromagnetic Interference Filters
- B. When requested for verification, provide copies of the following:
  - 1. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
  - 2. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

1.3 SUBMITTALS

- A. Submit shop drawings complete with all technical information for specific unit dimensions, let through voltage data, detailed installation instructions, maintenance manual, and wiring configuration.
- B. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.
- C. Copies of Manufacturer's catalog data, technical information and specifications on equipment.
- D. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and multi-listed to UL 1449 5<sup>th</sup> Edition and UL 1283.
- F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.4 WARRANTY

- A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure

SURGE PROTECTION DEVICES

SPDs. Very high exposure unit warranties shall include exposure to temporary extended over-voltage conditions. Provide a minimum 15-year warranty for all medium exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date of substantial completion against failure. Contractor shall assist the Owner with manufacturer warranty registration.

## PART 2 – PRODUCTS

### 2.1 APPROVED MANUFACTURER

- A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
1. Recessed mount panelboard extension with brushed stainless-steel front:
    - a. ACT Communications:471- ###V-050-SS-F-PB flush series.
    - b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
    - c. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
    - d. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS(Stainless Steel front).
  2. Branch panelboard surface mounted:
    - a. ACT Communications 455 series.
    - b. ABB Current Technology CG3 60 series.
    - c. SSI Surge Suppression, Inc. CSMx12 series.
    - d. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C
- B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
1. ACT Communications 471 series.
  2. ABB Current Technology CGP3 125 series.
  3. SSI Surge Suppression, Inc. CSMx24 series.
  4. SST Southern Tier Technologies T45-VVVV-120A series
- C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
1. ACT Communications 471 x200 series.
  2. ABB Current Technology TG3 200 series.
  3. SSI Surge Suppression, Inc. CHLxM series.
  4. SST Southern Tier Technologies T45-VVVV-200A series
- D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 1 and 2 SPD:
1. ACT Communications 471 x200 SEL series.
  2. ABB Current Technology SEL3 200 series.

The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

\*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

### 2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

#### SURGE PROTECTION DEVICES

- A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.
- B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.
- C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

- D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
1. 14 dB from 10 kHz to 1 MHz.
- E. Each Unit shall provide the following features:
1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
  2. Field testable while installed.
  3. High performance interconnecting cable.
  4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to the SPD unit.
  5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20kA
  6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
  7. The unit shall be listed as a Type 2 SPD per UL1449.
  8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units.

## 2.3 POWER CABLES FOR CONNECTION

- A. Power wiring: Conductors between all high and very-high SPDs and switchgear shall be high performance interconnect system "Low Z Cable" cables with Ultra Low impedance characteristics at 10kHz and above.
- B. High Performance Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

## PART 3 – EXECUTION

### 3.1 GENERAL INSTALLATION

- A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection device for disconnect shall be provided and as recommended by the manufacturer.

## SURGE PROTECTION DEVICES

- B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.
- C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.
- D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer's recommendations shall prevail over the information given in the plans and specifications.
- E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front material and finish. Provide brushed stainless-steel front at kitchens and food processing areas.

### 3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

- A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
  - 1. Service entrance rated 1,201 Amps and above.
- B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
  - 1. Service entrance rated 801 – 1,200 Amps.
  - 2. Switchboards located outside.
- C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
  - 1. Service entrance rated 401 - 800 Amps.
  - 2. Panelboards above 600 Amps.
  - 3. Motor control centers.
  - 4. Non-service entrance switchboards.
- D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where indicated:
  - 1. Service entrance rated 400 Amps and below.
  - 2. Panelboards 600 Amps and below.

### 3.3 TESTING

- A. Factory Trained Representative shall provide start-up to include initial verification of proper installation, shortest cable connection, and initiate factory warranty. The technician will be required to do the following as a minimum:
  - 1. Verify the installation follows applicable national / local electrical codes related to SPDs and the manufacturer's Installation, Operation and Maintenance Instructions and recommendations.
  - 2. Verify overcurrent device rating.
  - 3. Verify all wiring connections and installation conforms to manufacturer's recommendations.
  - 4. Record information for each product installed and include in O&M Manual
- B. A copy of the Factory diagnostic test report and written approval of the installation shall be included with the Electrical Operating and Maintenance Manual. The Contractor shall make all adjustments, changes, corrections, etc. as required by the Factory Trained Representative so that the installation follows the manufacturer's installation and operation instructions without additional charge to the Owner.

END OF SECTION

### SURGE PROTECTION DEVICES

SECTION 26 51 13

LIGHTING FIXTURES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Work Included: Lighting fixture work is as shown, scheduled and specified.
- B. Applications: The applications of lighting fixtures required for the project include the following:
  - 1. General lighting
  - 2. Emergency lighting
  - 3. Outdoor area lighting

1.2 QUALITY ASSURANCE

- A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.
- B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.
- C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

- A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.
- B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.
- C. Submittal data shall include luminaire efficiency parameters.
- D. Submittal data for exterior luminaires shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

- A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific component warranty requirements below.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.
  - 1. Light fixtures:
    - US LED
    - Extra Light

LIGHTING FIXTURES

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- Acuity
- Hubbell
- Signify
- Cooper Lighting Solutions
- Pinnacle
- HE Williams
- GE Current
- LSI
- 2. LED Drivers:
  - Philips
  - Osram Optotronic
  - Eldo LED
- 3. Emergency Battery Packs with self-testing drivers/inverters:
  - Bodine
  - Chloride
  - Lithonia
  - Dual Lite
  - IOTA
- 4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible:
  - Bodine
- 5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
  - Bodine GTD20A

## 2.2 MATERIALS AND COMPONENTS

- A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.
- B. Fixture Types:
  - 1. General:
    - a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
    - b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
    - c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
    - d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
    - e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
    - f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
    - g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
    - i. Color Rendering Index (CRI):  $\geq 80$  Indoor;  $\geq 65$  Outdoor
    - j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
  - 2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
  - 3. LED Exit Signs: Provide red lettering. The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
    - a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafeteriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia

## LIGHTING FIXTURES

Extreme Series.

4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
  5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.
- C. LED drivers:
1. NEMA 410 compliant for in-rush current.
  2. Starting Temperature: -40° F [-40° C].
  3. Input Voltage: 120 to 480 (±10%) V.
  4. Power Supplies: Class I or II output.
  5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
  6. Power Factor (PF): ≥ 0.90.
  7. Total Harmonic Distortion (THD): ≤ 20%.
  8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
  9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
- D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.
- E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.
- F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
1. Bodine BSL-ST Series for OEM installation
  2. Bodine BSL310-SI Series for field installation
  3. Bodine ELI-S Series for line voltage sine wave inverter field installation
- G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.
- H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load
  2. Compatible with 0-10 Volt dimmer switches
  3. UL 924
  4. Minimum 3-year warranty
  5. Integral or remove test switch.
- I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
  2. 20 Amp ballast/driver load
  3. 0-10Vdc dimming compatible

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.
- B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.
- C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of

fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.

- D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.
- E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner's designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.
- F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafeteriums and kitchens.
- G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.
- H. Install in accordance with manufacturers instructions.
- I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
- J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.
- K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.
- M. Install recessed luminaires to permit removal from below.
- N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- O. Install wall-mounted luminaires at height as directed by Architect.
- P. Install accessories furnished with each luminary.
- Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.
- R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.
- S. Bond products and metal accessories to branch circuit equipment grounding conductor.
- T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.
- U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.
- V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.

- W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.
- X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Provide separate lighting contactors for:
  - 1. Parking Lot Lighting
  - 2. Building Mounted Lighting
  - 3. Exterior Signage
- Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.
- Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.
- AA. Lighting Fixture Supports:
  - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
  - 2. Shall maintain the fixture positions after cleaning and relamping.
  - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- BB. Hardware for surface mounting fixtures to suspended ceilings:
  - 1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
  - 2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.
- CC. Lighting Fixture Supports for aluminum canopies:
  - 1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

### 3.2 TESTING

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

SECTION 26 55 61

HIGH SCHOOL AUDITORIUM AND BLACKBOX THEATRICAL LIGHTING SYSTEM

PART 1 – GENERAL

1.1 INTENT

- A. The intent of this specification is to define parameters for furnishing and installing a complete and working renovated dimming system in the high school auditorium and a new dimming and control system in the black box. Performance deviations will not be accepted. One company shall be responsible for installing or coordinating the installation of all aspects of the stage equipment. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, commissioning, etc., necessary to complete installation of new stage equipment.
- B. The contractor shall remove existing theatrical lighting components and retain existing infrastructure needed for the installation of the new equipment. Refer to drawings for additional information.
- C. All work must be in compliance with the National Electric Code and applicable local codes.
- D. The contractor is responsible for providing a complete and working system. All items needed for a complete working system meeting the design intent of the plans and specifications are to be included, even if not specifically listed.
- E. Refer to plans for locations and quantities of equipment for auditorium and black box spaces.

1.2 APPROVED EQUIPMENT

- A. Dimming, Controls, and Fixtures:
  - 1. Basis of design: Electronic Theatre Controls.
  - 2. Strand Lighting
- B. Follow spot:
  - 1. CantoUSA

1.3 SUBSTITUTIONS

- A. Specific items of equipment are listed by trade names. It is neither the purpose nor intent of these documents to eliminate competitive proposals.
- B. Accompanying each request shall be a letter specifically detailing each substitution including catalog data, specifications, operative samples, technical information, drawings, performance and test data, and complete descriptive and functional information to assist in a fair evaluation. Substitution requests shall be submitted for each component of the lighting and rigging system and shall be evaluated separately. Requests shall also include a detailed line-by-line specification compliance letter. Any deviations from the specifications or drawings shall be listed and explained. Failure to submit any substitution for prior approval or not providing sufficient data for evaluation shall require the exact item specified to be furnished. Approval will be granted by Addenda Only.
- C. Owner's approval of a substitution for proposal purposes will not relieve the contractor from the responsibility of meeting all specification criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes such substitution shall require.

1.4 QUALITY ASSURANCE

- A. To ensure a complete uniform installation and single point of responsibility for system design and warranty, one manufacturer shall provide all dimming, rigging, control system and fixture components. The mixing of equipment brands will not be accepted.

HIGH SCHOOL AUDITORIUM AND BLACKBOX THEATRICAL LIGHTING SYSTEM

- B. Manufacturer shall provide local on-site service for the system for a period of two years from date of acceptance by the Owner. This person or firm must be regularly engaged in the service of dimmers. A salesperson or sales agent without dedicated service personnel does not meet this requirement.
- D. This specification details specific operational and functional needs of the Owner. Deviations from the performance requirements will not be accepted from any supplier. Contractor assumes the responsibility of removing any non-complying material discovered during the warranty period and replacing it with specification compliant equipment.
- E. Due to the specialty nature of theatrical lighting equipment, a Theatrical Systems Contractor shall provide the theatrical dimming, rigging, and control equipment to the Project Electrical Contractor, as well as providing support and coordination services to ensure a complete working system.
- E. The Theatrical Systems Contractor shall be an authorized dealer of the specified manufacturers and have been actively engaged in the sales, installation, commissioning, repair, and maintenance of theatrical lighting equipment for no less than ten (10) years. Evidence of experience for projects of similar size and scope shall be submitted if requested. This evidence shall include a reference list for a minimum of five projects including: job name, contact name and phone number, scope, and contract value.
- F. The Theatrical Systems Contractor shall be an authorized service center for repair and support of the specified dimming products with a dedicated manufacture certified service technician available for local support.
- G. The Theatrical Systems Contractor shall directly employ personnel with the manufacture's Rigging Certification for the installation of all overhead rigging components.

#### 1.5 SERVICES

- A. Services of qualified project manager, representing the manufacturer, and employed full time in the sales and service of control systems, shall be provided during the installation period to answer questions and review the installation.
- B. Services of a qualified technician, representing the manufacturer, and employed full time in the service of control systems, shall be provided for one visit upon 21 days' notice. This technician shall terminate all low voltage control wiring, inspect the installation, energize the system, and program and commission the theatrical lighting control system. The technician shall also instruct the Owner in proper operation and maintenance of the system.
- C. During the warranty period, the manufacturer shall provide a toll-free 24-hour-per-day number for telephone technical support and service requests.

#### 1.6. DRAWINGS

- A. Dimming System Manufacturer shall provide .pdf electronic files for submittals, including system risers, rack schedules, and manufacturer cut sheets for all equipment.
- B. Dimming System Manufacturer shall provide .pdf electronic files for Operation & Maintenance Manuals, to include Operation Manuals for all supplied equipment.

#### 1.7 WARRANTY

- A. The dimming manufacturer shall provide a two (2) year parts and labor warranty on the entire theatrical lighting system from date of acceptance. This warranty shall be totally inclusive of service calls, travel, etc. at no additional cost to the Owner.
- B. The dimming manufacturer shall provide a five (5) year parts warranty on all LED theatrical light fixtures. The LED light array shall have a ten (10) year parts warranty

#### 1.8 SCOPE OF WORK

- A. This section includes the following lighting control system equipment
  - 1. Dimmers
  - 2. Controls
  - 3. Distribution
  - 4. Lighting instruments, lamps, and associated portable equipment
- B. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete the installation of new stage equipment as detailed in these specifications and accompanying documents.
- C. The Auditorium system shall be completely renovated per plans: Upgrade the existing dimmer rack with a new 3-year parts and labor warranty, provision of new relay modules in quantities as needed, replacement of all house light fixtures, and replacement of all theatrical fixtures, theatrical work lights, and controls.
- D. The new Black Box shall be provided with new controls and fixtures as shown on plans and as required for a fully operational system.
- E. The Theatrical Systems Lighting Contractor shall be responsible for the following:
  - 1. Provide all dimming, control, and distribution equipment as detailed and required in these specifications and associated drawings and as needed for a fully functional system.
  - 2. Provide shop drawings indicating system layout, control wiring, physical mounting locations, and mounting techniques of all equipment.
  - 3. Install motorized and dead rigging, dead hung pipes, pipe mounted circuit boxes, and raceways as required.
  - 4. The Theatrical System Lighting Contractor shall employ only fully trained stage riggers and mechanics for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent job superintendent shall be on the job at all times when work is in progress. The job superintendent must be certified in theatre rigging by the manufacturer. A copy of the certification must be furnished to the General Contractor prior to the start of the installation.
  - 5. Provide Factory Authorized Service Technician to perform system commissioning, low voltage terminations, installation of control plates, system programming. Technician shall provide a minimum of eight hours of training, four hours on two separate days, to Owner's Representative. Coordinate training schedule with Owner.
  - 6. Provide all lighting fixtures and accessories as indicated or required. All fixtures shall be unboxed, lamped, aligned, hung, and focused into a stage wash.
  - 7. Provide control setup and training for the Owner, including fixture patch and zone control of the complete lighting plot. Provide a minimum of 4 standard stage presets for typical stage uses as a starting point for the Owner: Label them: "Rehearsal", "Speaker", "Performance" and "AV". Program up to four (4) additional presets as requested by the Owner.
- F. The Project Electrical Contractor shall be responsible for the following, with performance requirements as specified in other Division 26 specifications:
  - 1. Installation of all dimming and control racks and equipment, including mounting of racks on walls, power feeds as required, and installation of custom back boxes.
  - 2. Provision and installation of all standard back boxes
  - 3. Provision and installation of all 120-Volt distribution circuits, and all 120/208-Volt feeder circuits for the theatrical lighting system
  - 4. Terminating of all 120v and 120/208v power and distribution circuits, both in the dimmer cabinet, and at the circuit distribution.
  - 5. Provision and installation of all conduits, junction boxes, electrical wire ways, and cable trays as required for the lighting systems, including low voltage control systems.
  - 6. Pulling all high and low voltage cables into conduit.
  - 7. Clean all racks, panels, and boxes of dirt, dust, and debris, re-assemble all equipment, and replace all panels, covers, and screws prior to time of system factory energization and training.
  - 8. Coordination with the Theatrical Contractor on all aspects of the rigging and electrical installation and low voltage cable runs. Follow all manufacturer submittal plans and installation recommendations. Actively facilitate coordination with the General Contractor

HIGH SCHOOL AUDITORIUM AND BLACKBOX THEATRICAL LIGHTING SYSTEM



and Structural Engineer for all structural attachment needs. Schedule adequate time at the end of the job for Theatrical Systems Contractor to commission the system before turnover to the owner and before substantial completion.

9. At time of System Commissioning, Project Electrical Contractor is responsible for providing access to all low voltage termination points for termination and testing to the Service Technician. This includes lifts, ladders, temporary lighting, and personnel required to reach any position the Service Technician needs access to. Electrical Contractor shall also provide personnel as needed to the Service Technician for troubleshooting and any needed wiring changes, terminations, or testing. These personnel shall be made available whenever the service technician is on the job site.
10. Electrical Contractor is responsible for advance scheduling with the Theatrical Systems Contractor. Theatrical Systems Contractor shall be given at least 21 days' notice of request for system startup. The Electrical Contractor is responsible for having all equipment installed and wiring pulled & terminated prior to the arrival of the Theatrical Systems Contractor Service Technician for commissioning. If the jobsite is not ready when the Theatrical Systems Contractor has been scheduled to arrive, and additional trip(s) are necessary, the Electrical Contractor shall pay necessary additional trip charges at no additional cost to the Owner.

- G. Provide all components necessary to make the system a complete and working lighting system.
- H. Verify site conditions and system layout during the project approval process, coordinating with other trades as required.

## 1.9 SUBMITTALS

- A. Submit product data for theatrical dimming equipment, controls, and fixtures.
- B. Submit project superintendent's factory certifications for theatre rigging.
- C. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

## PART 2 – PRODUCTS

### 2.2 ENTERTAINMENT CONTROLS (EOS)

- A. Product: Ion XE 20 as manufactured by ETC Inc.
  1. Model Ion Xe 20 2K: Ion Xe 20 console, 2,048 outputs (base)
  2. Power consumption: Approximately 2 A at 120 V or 230/240 V.
  3. Ambient Room Temperature: 32 to 95 degrees F (0 to 35 degrees C).
  4. Ambient Humidity: Up to 90 percent non-condensing.
  5. Regulatory Compliance: CE compliant, cETLus listed, UKCA marked, FCC compliant, RoHS compliant, and WEEE.
  6. Hardware and Interfaces:
    - a. Supports two external display port monitors (1920 x 1080 min, 3840 x 2160 max). Optional single-touch or multi-touch screen control and DDC/CI support.
    - b. Twenty 45 mm standard faders, 100 10-fader pages configurable as channels, submasters, palettes/presets, timing, and effect rate/speed playback control.
    - c. Two internal monochromatic LCD displays for fader content.
    - d. Main Playback with two 100 mm standard faders.
    - e. Four encoders for non-intensity parameter control.
    - f. Dedicated high-resolution intensity level wheel.
    - g. Backlit Eos keypad.
    - h. Included USB keyboard.
    - i. Solid-state hard drive.
    - j. IEC Power Input: 100 to 240 Vac at 50/60 Hz, fused mains power switch, locking

- regionalized power cable included.
- k. Two individually configurable Gigabit Ethernet ports, RJ45 connectors.
- l. One 802.11ac Wi-Fi Ethernet adapter. To be enabled with future software.
- m. Bluetooth 5.1 for connecting input accessories. To be enabled with future software.
- n. sACN and Art-Net network output protocols.
- o. Four DMX-512 / RDM 5-pin XLR ports.
- p. Contact closure triggers via D-Sub connector.
- q. USB 3.1 ports, for flash drives, pointing devices, keyboards.
  - 1) USB-A Ports: 5. USB-C Ports: 2
- r. One Littlite XLR port.
- s. One Kensington lock port.
- t. Multiple MIDI and/or SMPTE timecode inputs, MIDI In and Out, Analog/Serial Inputs, OSC transmit/receive, UDP transmit/receive through network interface or Response Gateways.

## 2.3 ENTERTAINMENT CONTROLS (MULTIVERSE)

- A. Product Multiverse Node as supplied by ETC Inc.
  - 1. Model:5902 (900 MHz / 2.4 GHz)
  - 2. Use Environment: Indoor.
  - 3. Regulatory Compliance: FCC and IC. IP Rating: IP50.
  - 4. Warranty: One year.
  - 5. Physical:
    - a. Length: 4.05 inch (102.8mm). Width: 2.36 inch (60 mm). Height: 1.44 inch (36.47 mm)
    - 1.44 inch.
    - b. Antenna: 3dBi.
    - c. User Interface: 4 Button/Backlit LCD display.
    - d. Construction: Die Cast Aluminum, Black.
    - e. Power Connector: Locking DC Jack, 5.5 x 2.1 mm, center positive, 12.1 mm mating depth.
  - 6. Electrical:
    - a. Power: 5 to 30 Vdc, 1W
    - b. Broadcast Power: 3.2 mW, 10 mW, 32 mW, and 100 mW.
    - c. Broadcast Modes: Adaptive, Full, Low, Mid, High, Max.
    - d. DMX Burst Modes: Auto dynamic.
    - e. Ethernet Protocols: N/A.
    - f. SHoW IDs: Multiverse: 307; Neo: 70.
    - g. RF Sensitivity: -95 dBm.
    - h. RDM Features: RDM Proxy, and RDM Responder.

## 2.4 ENTERTAINMENT CONTROLS (RESPONSE)

- A. Product: Response Mk2 Four-Port Gateway by ETC Inc.
  - 1. Model: RSN-DMX4-T Response Mk2 4-Port Gateway 4 Terminal.
  - 2. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
  - 3. Functional:
    - a. Supports Net3/ACN per ANSI E1.31 and E1.17, RDM (ANSI E1.20), and Supports USITT DMX512-A per ANSI E1.11.
    - b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.
    - c. Flexible Output Patch: Allows a 512-address universe to begin at any output address.
    - d. Advanced Input Patch.
    - e. Support for per-addressor per-universe-level priority.
    - f. Delay Time: From input to output not greater than one packet time.
    - g. Selectable DMX refresh rate: Maximum of 40 Hz.
    - h. Supports 256 total RDM devices.
  - 4. Mechanical:
    - a. Intuitive four-button interface.
    - b. Onboard display for identification, status, and configuration.
    - c. Fabricated from 16-gauge cold-rolled steel.
    - d. Finish: Black, Fine-textured, powder-coat.

- e. C-clamp and U-bolt hardware available.
  - f. Half 19-inch equipment rack width allows eight DMX ports in 1U height.
  - g. Network, power, and data activity LED indicators.
    - 1) Blue power indicator, green network activity indicator.
    - 2) Bi-color DMX activity indicator.
  - h. Repositionable RJ45 connector for connection to lighting network.
  - i. Reset button for hard reset or forced reboot.
  - 5. Environmental:
    - a. Ambient Operating Temperature: 32 to 104 degrees F.
    - b. Operating Humidity: 95 percent non-condensing.
    - c. Storage temperature: Minus 40 to 158 degrees F.
  - 6. Electrical:
    - a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet.
    - b. Power Input: 12 to 24 VDC for use with non-PoE systems.
    - c. Maximum seven-watt current draw.
  - 7. Configuration:
    - a. Local configuration options.
    - b. Remote configuration by Concert.
      - 1) Supports 512 DMX addresses per port.
      - 2) Supports 63,999 Streaming ACN universes.
    - c. DMX data input or output configurable by user.
    - d. Multiple sources may be combined to the network with each source or address allowing an independent priority.
    - e. Individual port start address and offset.
    - f. User-configurable labeling.
- B. Product: Response Mk2 One-Port Gateway by ETC Inc.
- 1. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
  - 2. Color: As determined by the Architect from the Manufacturer's offering.
  - 3. Functional:
    - a. Supports Net3/ACN per ANSI E1.31 and E1.17, RDM per ANSI E1.20, and USITT DMX512-A per ANSI E1.11.
    - b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.
    - c. Flexible Output Patch allows a 512-address universe to begin at any output address.
    - d. Advanced Input Patch.
    - e. Support for per-addressor per-universe-level priority.
    - f. Maximum delay time from input to output not greater than one packet time.
    - g. Selectable DMX refresh rate: At least 40 Hz.
    - h. Supports 256 total RDM devices.
  - 4. Mechanical:
    - a. Intuitive four-button interface,
    - b. Onboard display for identification, status, and configuration.
    - c. Enclosed electronics assembly and faceplate.
    - d. No visible means of attachment.
    - e. Flush-mount in industry standard backbox, RACO 690 or equivalent. Surface-mounted backboxes available.
    - f. Construction: Injection-molded, ABS plastic.
    - g. Green LED: For network activity indication.
    - h. RJ45 connector for connection to lighting network.
    - i. Reset button: For hard reset or forced reboot.
  - 5. Environmental:
    - a. Ambient Operating Temperature: 32 to 104 degrees F.
    - b. Operating Humidity: 95 percent non-condensing.
    - c. Storage temperature: Minus 40 to 158 degrees F.
  - 6. Electrical:
    - a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet.
    - b. Power Input: 12-24 Vdc for use with non-PoE systems.
    - c. Maximum power draw: 4 W.

7. Configuration:
  - a. Local configuration options.
  - b. Remote configuration by Concert.
    - 1) Supports 512 DMX addresses per port.
    - 2) Supports 63,999 Streaming ACN universes.
  - c. DMX data input or output configurable by user.
  - d. Multiple sources may be combined to the network with each source or address allowing independent priority.
  - e. Individual port start address and offset.
  - f. User-configurable labeling.
- C. Product: Response Mk2 Two-Port Gateway by ETC Inc.
  1. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
  2. Two-Port Gateways: Portable.
    - a. Model: RSN-DMX2-O-P. Portable 2-port Gateway. 2 Output.
  3. Color: As determined by the Architect from the Manufacturer's offering.
  4. Functional:
    - a. Supports Net3/ACN per ANSI E1.31 and E1.17, RDM per ANSI E1.20, USITT DMX512-A per ANSI E1.11.
    - b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.
    - c. Flexible Output Patch allows a 512-address universe to begin at any output address.
    - d. Advanced Input Patch.
    - e. Support for per-addressor per-universe-level priority.
    - f. Maximum delay time from input to output not greater than one packet time.
    - g. Selectable DMX refresh rate with a maximum of at least 40 Hz.
    - h. Supports up to 256 total RDM devices.
  5. Mechanical:
    - a. Intuitive four-button interface.
    - b. Onboard display for identification, status, and configuration.
    - c. Enclosed electronics assembly and faceplate.
    - d. No visible means of attachment.
    - e. Flush-mount in industry standard backbox, RACO 690 or equivalent. Surface-mounted backboxes available.
    - f. Construction: Injection-molded, ABS plastic.
    - g. Network and power activity LED indicators.
      - 1) Blue power indicator, green network activity indicator.
      - 2) RJ45 connector for connection to lighting network.
    - h. Reset button: For hard reset or forced reboot.
  6. Environmental:
    - a. Ambient Operating Temperature: 32 to 104 degrees F.
    - b. Operating Humidity: 95 percent non-condensing.
    - c. Storage temperature: Minus 40 to 158 degrees F.
  7. Electrical:
    - a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet.
    - b. Power Input: 12 to 24 VDC for use with non-PoE systems.
    - c. Current Draw: Maximum 4 W.
  8. Configuration:
    - a. Local configuration options.
    - b. Remote configuration by Concert.
      - 1) Supports 512 DMX addresses per port.
      - 2) Supports 63,999 Streaming ACN universes.
    - c. DMX data input or output configurable by user.
    - d. Multiple sources may be combined to the network with each source or address allowing an independent priority.
    - e. Individual port start address and offset.
    - f. User-configurable labeling.
- D. Product: Response Opto-Splitter by ETC Inc. Provides quality and reliable DMX data distribution using industry-standard DMX and RDM.
  1. Model: RSN-OPTO-16T. 16 Port Rackmount Terminal.

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2. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
3. Functional:
  - a. No configuration required.
  - b. Supports DMX512, DMX512 (1990), DMX512-A, ANSI E1.20 Remote Device Management (RDM).
  - c. Supports 256 total RDM devices.
4. Mechanical:
  - a. Rack-mount form factor:
    - 1) Aluminum fabrication.
    - 2) Fine-textured, powder-coat finish. Color: Black.
    - 3) Equipment Rack Width: Full 19 inch.
    - 4) Mounting: Front or rear facing.
  - b. DIN rail form factor:
    - 1) Enclosure: Molded plastic.
    - 2) Mounting: Complies with DIN43880 (35/7.5 rail).
    - 3) The unit is 9 DIN units wide.
    - 4) DIN installation enclosure available.
  - c. Power and Data Activity LED Indicators: Power: Blue. DMX activity: Green.
5. Environmental:
  - a. Ambient Operating Temperature: 32 to 104 degrees F (0 to 40 degrees C).
  - b. Operating Humidity: 5 to 95 percent non-condensing.
  - c. Storage temperature: -40 to 158 degrees F (-40 to 639 degrees C).
6. Electrical:
  - a. Supports DMX input and DMX through.
  - b. Provides optically isolated DMX/RDM outputs.
  - c. Rack-Mount Form Factor:
    - 1) Power Unit: 100 to 240 VAC 50/60 Hz.
    - 2) User configurable front or rear IEC C13 power connector position.
    - 3) Power Draw: 35 W max.
    - 4) XLR, RJ45 and Terminal connector options.
  - d. DIN Rail Form Factor:
    - 1) Power Input: 12 to 48 Vdc power input.
    - 2) Power Draw: 8 W max.
    - 3) Wiring connections use pluggable rising clamp terminals.
  - e. DIN Box form factors include a suitable power supply.

## 2.5 POWER CONTROL ENCLOSURES

- A. Product: Sensor3 Installation Enclosures (SR3) by ETC Inc. Power control system with high-density, professional features and exceptional reliability for lighting applications requiring power control.
  1. SR3-48 Enclosure: 48 modules, 96 circuits maximum.
  2. Mechanical:
    - a. Construction: 16 ga steel.
    - b. Finish: Fine-textured, scratch-resistant epoxy paint.
    - c. Top and Bottom Conduit: Access through removable panels (SR3-48) or knockouts (SR3-6, SR3-12, and SR3-24).
    - d. Keyed module slots prevent insertion of incompatible module types.
    - e. Front access to all wiring and terminations.
    - f. Full height locking door.
    - g. Electrostatic air filter easily removed from door for periodic cleaning.
    - h. High-efficiency cooling system with reporting.
    - i. High-visibility LED status beacon.
  3. Electrical:
    - a. SR3 Enclosures Accept the Following Feeds:
      - 1) Power: Three-phase 120 / 208 Vac.
    - b. Line Feed Frequencies: 47 to 63 Hz.
    - c. Line Feed Voltage Range: 91 to 139 Vac. Max main transformer tap recommended is 135 V to allow for line fluctuation.
    - d. Short Circuit Current Rating: 100,000 Amps RMS symmetrical.
  4. Thermals:

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- a. 32 to 104 degrees F. Electrical Room HVAC Systems: Must maintain the specified ambient temperature at all times.
- b. Relative Humidity: 10 to 90 percent non-condensing.
- 5. Control: CEM3 Power Control Processor.
  - a. Construction:
    - 1) Body: Formed steel.
    - 2) Face Panel: Diecast.
    - 3) Finish: textured epoxy paint.
  - b. Slide-In Module: Toolless installation and removal. Spring-loaded release.
  - c. Airflow Sensor: Ensures adequate airflow.
  - d. Two configurable DMX512 inputs (rear, 2500 V opto-isolated).
  - e. Two Ethernet ports:
    - 1) Front: for direct service connection.
    - 2) Rear: for operation of lighting control network.
  - f. Graphical LCD: Eight lines by 20 character for system configuration, live control, and status display.
  - g. Number Pad: For quick access to dimmers.
  - h. Shortcut Buttons: For Setup, about, and live control.
  - i. Five Status LED Indicators: Power, Network activity, DMX-A DMX-B, and Panic.
  - j. User-Programmable Presets: 64.
  - k. UL 924 Listed Panic circuit with flexible configuration.
  - l. Configuration Backups: Saved on USB or network.
  - m. Dimmer Outputs: Regulate to maintain constant power plus or minus 1 Volt.
  - n. Individual output scale voltage settings for load wiring compensation.
  - o. Selectable Firing Modes: Normal, Forward Phase, Reverse Phase, Dimmer Doubled, Sinewave, and Fluorescent.
  - p. Control Modes: Dimmed, Switched, Latch/lock, Always On, and Off.
  - q. Selectable Dimmer Output Curves: Linear, Modified Linear, Square, Modified Square, Sensor 2.0, and five custom curves.
  - r. 16-bit fade resolution. Greater than 30,000 Step Resolution per 1/2 cycle.
  - s. Selectable data loss behavior.
  - t. Feedback:
    - 1) Sensor racks with CEM3 modules include basic system diagnostic reporting.
    - 2) Standard Rack Feedback Includes: DMX input status, rack power status, and rack temperature.
    - 3) Advanced Features (AF): Provides dimmer-specific status and load feedback. Requires AF dimmer rack and AF dimmer modules.
  - u. Mobile Application: ThruPower System Reporter (TPSR).
    - 1) Mobile application shall select the circuit to configure either by scanning a QR code label applied to circuit distribution or by manual entry of circuit information.
    - 2) Mobile application shall allow users to set the Control Mode of the selected circuit in order to shift a ThruPower module between Dimmable and Switched mode according to the requirement of a connected load.
    - 3) Mobile application shall allow users to activate the circuit test function for the selected module.
    - 4) Power controls which do not support mobile circuit configuration from the plugin location of a supported load shall not be acceptable.
- 6. Power Control Modules:
  - a. Rated for continuous duty at 100 percent of rated load.
  - b. Circuits: 1.2 kW, 1.8 kW, 2.4 kW, and 6 kW.
  - c. Physical: Dual density (two circuits per module), modular plug-in assemblies. Keyed to prevent improper insertion.
  - d. Cast aluminum chassis, finished with textured epoxy paint.
  - e. Circuit Breakers: Fully magnetic to eliminate nuisance tripping.
    - 1) Inrush Current Rating: 20x.
    - 2) Must Trip Rating: 125 percent, 10 to 100 seconds.
    - 3) Rated for 100 percent switching duty applications.
- 7. Power Device: Sealed, patented assembly. Field-replaceable with screwdriver.
  - a. Per-circuit LED indicators.
  - b. Mechanical held air gap relay.
  - c. Integral bonded heatsink.
  - d. Integral temperature sensor.

8. Filtering: High quality toroidal filters.
  9. Sensor3 Module Series:
    - a. Relay Series: Air-gap relays for switched power control.
  10. Standards Compliance: Listed: cULus.
  11. Quantities and configurations of Sensor3 enclosures, modules, and accessories to be supplied as shown on project drawings.
- B. Echo Relay Panel Feedthrough (ERP-FT) by ETC Inc. 48-output branch circuit switching and power control enclosure. Integrated DMX and Ethernet connectivity. Optional 0-10 V, DALI, and contact input control cards. UL 924 listed for emergency lighting control.
1. Mechanical: Enclosure covers with locking doors, and internal subpanels.
    - a. Construction: Steel, 16 ga.
    - b. Finish: Fine-textured, scratch-resistant powder coat paint. Color: Black.
    - c. Removable Conduit Panels: On top, bottom, and sides.
    - d. Full Front Access: No side clearance required.
    - e. Removable Covers: For access to Class 1 and 2 wiring.
    - f. Locking Doors: Controlled access to manual override switch of each relay and Class 2 wiring.
    - g. Low-Voltage Wiring: Physically separated from AC by a mechanical barrier.
    - h. Removable Subpanels: Containing electronics and relays.
  2. Thermal:
    - a. Operating Temperature: 32 to 104 degrees F (0 to 40 degrees C).
    - b. Humidity: 10 to 90 percent, non-condensing.
  3. Electrical:
    - a. Discrete feed per circuit supports mixed voltage in a single panel.
    - b. Single panel for 48 relays, populated in any combination of single- or double-pole.
    - c. Separate Wiring Chambers: For Class 1 and Class 2 terminations.
    - d. Voltage barriers: Toolless installation between relays. Separation of normal and emergency circuits.
  4. Relay Kits:
    - a. ERP-FT-1PRK: single-pole, 120-347 V, 20 A relay kit.
  5. Relay Ratings:
    - a. General Purpose: 20 Amp, 347 V.
    - b. Ballast (HID): 20 Amp, 347 V.
    - c. Tungsten: 20 Amp.
    - d. Motor Loads: 0.5 HP at 120 V. 1.5 HP at 240/277 V.
    - e. SCCR: 18,000 Amp at 277 V, 1 Phase. 5,000 Amp at 277 V, 2 Phase.
    - f. Inrush: 2000 Amp; 1 P only.
    - g. Isolation: 2,500 V RMS.
    - h. State: Latching.
    - i. Relays are mechanically held.
    - j. Life: 60,000 operations at full load.
    - k. Terminal: Accepts 14 to 10 AWG copper wire.
  6. Control:
    - a. User interface:
      - 1) Graphical display with LED backlight.
      - 2) Button Interface With: 0 to 9 number buttons.
      - 3) Navigation Buttons: Up, down, back and enter.
      - 4) "Light bulb" test button for local preset activation, sequence and set level overrides.
      - 5) USB interface: For upload of setup and software updates.
    - b. User interface power input: 120 to 277 V, plus or minus 15 percent, 50/60 Hz. Less than 16 Amp.
      - 1) Multi-Tap Transformer Terminals: Accept 12 AWG wire.
    - c. Control Wiring Terminations: Accessible via flip down door.
      - 1) Control Terminals: Accept 12 AWG wire.
      - 2) Control Wiring Exiting Panel: Class 2.
      - 3) Control Terminations: Utilize removable connectors.
    - d. Relay Modes: Normal (priority/HTP), latch-lock or last-action.
    - e. Configurable DMX on/off threshold.
    - f. Control configuration:
      - 1) Sixteen spaces with 64 presets per space configurable via local UI.

- 2) One 16 step sequence per space.
- 3) UL924 Listed emergency control bypass.
- g. Configurable Data-Loss Behavior: Play preset; Hold last look; Wait and fade.
7. Standards Compliance: Listed to the following standards:
  - a. UL508 Listed (File: E92154) and UL924 Listed (File: E242514).
  - b. Complies with ANSI E1.11 DMX512-A and ANSI E1.31 streaming ACN.
8. Quantities and configurations of Echo Relay Panel Feedthrough enclosures, relay kits, and accessories to be supplied as shown on project drawings.

## 2.6 CIRCUIT AND DATA DISTRIBUTION

- A. Product: Circuit and data distribution as supplied by ETC Inc.
1. Pigtail and outlet boxes.
  2. Gridiron junction boxes.
  3. Electronic control plug-in boxes (ECPB).
  4. Mechanical:
    - a. Construction: Boxes constructed from 18 ga and 14 ga steel. NEMA and ECPB faceplates constructed of aluminum.
    - b. Finish: Fine-textured black powder coat.
    - c. Include mounting brackets and hardware.
  5. Electrical:
    - a. Wire Entry: Conduit knockouts to feed-through terminals individually labeled with corresponding circuit numbers.
    - b. Wire Exit: Connectorized receptacles, conduit knockouts, or cable glands.
    - c. Low voltage barriers or junction boxes as required.
  6. Finish: Fine-textured black powder coat paint.
  7. Circuit Labels: 2 in. (50 mm); vinyl; white lettering on black; front only.
  8. Standards Compliance: cULus Listed to UL 1573 and CSA C22.2 No. 166.
  9. Power and data distribution equipment to be supplied as shown on project drawings.

## 2.7 ARCHITECTURAL CONTROLS – ECHO

- A. Interfaces:
1. Product: Unison Echo EchoAccess Interface.
    - a. Model: EACC EchoAccess Interface.
    - b. Communication from EchoAccess mobile app to devices on EchoConnect system bus via Bluetooth Smart.
    - c. Mobile app available for Android and iOS.
    - d. Preset, zone and color control for Echo products.
    - e. Advanced feature configuration of Echo products.
  2. Standards Compliance: UL and cUL Listed. CE Compliant.
    - a. California Title 24 compliant.
  3. Functional: Unison Echo EchoAccess Interface.
    - a. Remote control of preset activation/deactivation, record, raise, lower, zone on/off control and room combine.
    - b. Control of Zone Intensity, Color, Tint, and Color Temperature.
    - c. Configuration of all Echo Control and Output Products.
    - d. Configurable security levels for both connection and configuration.
  4. Mechanical:
    - a. Flush-mount in industry standard backbox, RACO 690 or equivalent Constructed of injection-molded, ABS plastic.
    - b. Gangable for custom applications.
    - c. Enclosed electronics assembly and faceplate included.
    - d. Power and Bluetooth activity indicators.
      - 1) Blue power status indicator.
      - 2) Amber Bluetooth activity indicator.
  5. Electrical:
    - a. MicroSD card slot for firmware maintenance.
    - b. Connects to two-wire EchoConnect control networks through low-voltage Class 2 wiring.
      - 1) Topology-Free Wiring: Belden 8471 and No. 14 ESD drain wire.
      - 2) Two No. 16 AWG wires for 24 VDC auxiliary power when required.



6. Operational Room Temperature: 32 to 122 degrees F (0 to 50 degrees C).
7. Relative Humidity Non-Condensing: 5 to 95 percent.

B. Stations:

1. Standards Compliance: cULus Listed. CE Certified.
2. Functional:
  - a. Button and Fader Functions: preset activation/ deactivation, record, raise, lower, zone on/off control and room combine.
  - b. Blue button illumination for active status.
  - c. Amber or no button illumination for inactive status.
  - d. Fader halo-illumination displays actual output level.
  - e. Zone or preset control from any station with real-time user toggle.
3. Mechanical:
  - a. Enclosed electronics assembly and faceplate included.
  - b. No visible means of attachment.
  - c. Flush-mount in industry-standard backbox, RACO 690 or equivalent.
  - d. Surface-mount backboxes available from manufacturer.
  - e. Constructed of injection-molded, ABS plastic.
  - f. Cantilevered switch arrays with removable button caps.
  - g. User configurable legends on each button or use standard legends that come with each station. Field configurable without the use of tools.
  - h. Integral LED response indicator for each button with indication of active(blue) and inactive (amber or off) state.
4. Electrical:
  - a. Connect via EchoConnect control network. Low-voltage Class 2 wiring.
  - b. Topology-free wiring over Belden 8471 and one No. 14 ESD drain wire.
    - 1) Control Wiring: 1640 ft (500 m).
  - c. Belden 1583A or equivalent Ethernet control wire when used with Cat5 termination accessories.
    - 1) Control Wiring: 1000 ft (300 m) using CAT5.
  - d. Wiring: Bus, loop, homerun, or any combination of these.
  - e. Station Terminations: Removable connectors.
5. Operating Temperature Range: 32-122 degrees F (0-50 degrees C).
6. Relevant Humidity Non-Condensing: 5-95 percent maximum.

C. Power Modules:

1. Product: Unison EchoConnect Station Power Supply by ETC Inc.
  - a. Model E-SPS-DIN: DIN Rail Mount Station Power Supply with 24 V Aux.
2. Convert Input Power into Class II Low-Voltage Power with data line. Energize control stations, zone controllers, time clocks, and devices for multi-scene lighting control.
3. Electrical:
  - a. Utilize line-voltage power supplied by contractor, terminated inside dimming enclosure, or power supply.
  - b. EchoConnect Communications with Remote Devices: Control stations, zone controllers, time clock stations and other devices.
  - c. EchoConnect Network: Low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded). And one No 14 AWG drain wire for system not using grounded metal conduit.
    - 1) Topology Free Network: Bus, loop, home run, star, or any combination.
    - 2) Control Bus Wiring: Permit total wire runs of 1640 ft (500 m)
    - 3) Wiring Between Stations: Not to exceed 1313 ft (400 m).
    - 4) CAT5 Wiring: For systems not requiring topology free infrastructure or EchoConnect bus lengths not more than 1000 ft (305 m).
4. Capacity: Power for up to 16 control stations, zone controllers, time clock stations and other devices, and/or provide 24 V Auxiliary Power to devices that require it.

D. Touchscreen Control Stations to be Unison Echo EchoTouch Controller Mk2 by ETC, Inc. Controls 512 DMX addresses on up to 80 control zones.

1. Standards Compliance: cULus Listed and CE Compliant. FCC Compliant.
2. Operation: Graphic buttons, faders, and images on at least 7 user programmable default and fully graphical control pages.
3. Touchscreen: Integrated with ETC Unison Echo Controls.

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- a. Seven-inch, backlit liquid crystal display. Resolution: 800 by 400 pixels minimum, with capacitive multi-touch interface.
  - b. Bezels: Cast aluminum. Finish: Fine texture powder coat.
    - 1) Four colors: Cream, Gray, Black, or Signal White.
    - 2) No visible means of attachment.
  - c. Supports Surface, Flush and Rack Mounting.
    - 1) Flush-mount: To industry standard 3 gang back box.
    - 2) Surface Back Box Dimensions (WxHxD): 7.35 x 4.88 x 3.5 inches 187 x 124 x 3.5 89 mm) available from Manufacturer.
    - 3) Rack Mounting: Fit in standard 19-inch (483 mm) racks, no taller than 3 EIA rack units.
4. Electrical:
- a. RJ45 Ethernet Port: Connection to lighting system and Power over Ethernet.
  - b. Control Wiring: EchoConnect Connection terminals.
    - 1) Low-voltage, Class II unshielded twisted pair, type Belden 8471 and one No. 14 ESD drain wire, when not installed in grounded metal conduit.
    - 2) Topology free. Point-to-point, bus, loop, home run or any combination.
  - c. Power Input, Non-PoE: Two, No. 16 AWG stranded wires for 24 VDC.
  - d. Typical Current Draw: 400 mA.
  - e. Firmware Maintenance: USB type A connector.
  - f. Network:
    - 1) Network Cabling: Category 5 or better. Conform to TIA-568A/B. Installed by qualified network installers.
  - g. Functional System:
    - 1) Presets: 64. Contained in non-volatile electronic memory.
    - 2) Internal sequences: 4. Record user-selected zone levels.
    - 3) Touchscreen: Equipped with on-board help system.
    - 4) Software upgrades: Via USB drive only.
    - 5) USB Port: Show data to be saved for archival or transfer to other consoles or a personal computer.
  - h. Patching: Facilities for dimmers and multi-parameter devices via built in library of fixture definitions.
    - 1) Fixture Library: Updated via software-based updates. Create custom fixture definitions using an offline application.
    - 2) Touchscreen: Support patching, address setting, and mode changes using Remote Device Management (RDM) on local DMX/RDM port.
  - i. Playback Control: Customizable zone display. Rearrange graphical representations for control channels to mimic fixture positions in installation.
    - 1) Seven user customizable interactive pages.
    - 2) Color and white pickers.
    - 3) Touch-based parameter controls with reference-based palettes.
    - 4) Virtual level wheel.
  - j. Layout and Configuration: View and modify layout of user pages.
    - 1) Add, remove, or edit the following items: Preset buttons. Off buttons. Sequence buttons. Zone and space modifier buttons. Space combiner buttons. Zone fader.
    - 2) Three Options for Inactivity: Dim screen to level. Turn the screen off. Display user chosen inactivity image.
    - 3) Multiple Configurations: May be stored within an LCD Station.
5. Time Clock: Touchscreen built-in astronomical and real time event engine allowing presets and sequences activation.
- a. Support 80 Events: Astronomical, real-time, and manual control events in 16 control spaces.
  - b. Timed Events: Programmable via Touchscreen.
    - 1) Assigned to day types.
      - a) Day Types: everyday, weekday, weekend, and day of week.
    - 2) Activation: Based on sunrise, sunset, time of day, opened and closed events and configurable state-based engine.
    - 3) Compensate for regions using daylight saving time.
    - 4) Assignment to events via time clock user interface.
    - 5) Resumes automatically after power loss.
  - c. Support timed event hold. Timed Event Hold: Meet CA Title 24 requirements.
6. External Control: Control of lighting system through built-in UDP integration.

- a. Supports full control of lighting system using UDP strings.
  - 1) Security settings to limit incoming control strings to subscribers-only.
- b. Supports up to two subscribers for receiving status messages.
- c. Control and status integrations from 3rd party systems include:
  - 1) Zones.
  - 2) Channels.
  - 3) Presets.
  - 4) Spaces.
  - 5) Sequences.
  - 6) Lockout.

## 2.8 ARCHITECTURAL CONTROLS – PARADIGM

- A. Touchscreens:
  - 1. Product: Unison Paradigm Portable Touchscreen by ETC, Inc.
    - a. Model P-TS7-PE: 7 in Portable Touchscreen (NetConnect/Ethernet).
  - 2. Product: Unison Paradigm 7 inches Touchscreen by ETC, Inc.
    - a. Model P-TS7-E-X: Paradigm 7-inch Touchscreen.
  - 3. Standards Compliance: UL and cUL LISTED. CE Compliant.
  - 4. Functional:
    - a. Built-in setup interface, separate from user configured pages.
    - b. Configuration Upload from the Following Sources:
      - 1) LightDesigner software.
      - 2) USB Flash Drive, via built in USB port.
      - 3) SD media.
    - c. Ability to store multiple configurations and to select which configuration is active from an on-screen menu.
    - d. Allows at least 30 separate control pages.
    - e. Control Functions:
      - 1) Individual zone control.
      - 2) Preset record and selection.
      - 3) Room Combine Controls.
      - 4) Preset, color, sequence, macro, and custom function activation.
      - 5) Change, initiate, or override timed events.
      - 6) Multi-level electronic lockout.
    - f. Custom controls configured from LightDesigner software.
    - g. Custom graphics configured from ControlDesigner software.
    - h. Supports Windows 7 and newer HID compliant Touchscreen Displays.
    - i. Software controlled lock-out and control visibility using up to 5 unique passcodes.
  - 5. Mechanical:
    - a. LED-backlit, color LCD display with touchscreen interface.
    - b. Aluminum enclosure in black anodized finish.
    - c. Adjustable brightness and contrast for low light conditions.
    - d. 7-inch WVGA display (800x480) with 24-bit color.
    - e. LCD touchscreen covered by lid when in closed position.
    - f. 10 ft removable cable (NetConnect model only).
    - g. 1U 19-inch Rackmount kit.
  - 6. Mechanical:
    - a. Color LCD display with projected capacitive touchscreen interface with LED backlight.
    - b. 178 degree horizontal and vertical viewing angle.
    - c. Low-profile aluminum bezel finished in a fine-texture powder coat paint.
    - d. No visible means of attachment.
    - e. Manufacturer provided back boxes for surface and flush mount applications.
    - f. Adjustable brightness and contrast for low light conditions.
    - g. 7-inch WVGA, display (800x480).
  - 7. Electrical:
    - a. Connection to Unison Paradigm control system using Unison Heritage portable plug-in stations (UH1RS) or Ethernet Stations (UH-NET).
    - b. Linkconnect Network uses Topology free and polarity independent Class 2 control network over Belden 8471 plus two No. 16 for 24 Vdc Aux Power and one No. 14 ESD drain wire.

- 1) Wiring may be bus, loop, home-run, or any combination of these.
    - c. NetConnect wiring uses standard Ethernet Infrastructure over twisted pair ethernet.
      - 1) Star topology using standard PoE Ethernet Switches.
      - 2) PoE Class 2 Device (6 W).
  8. Electrical:
    - a. Connection to Paradigm Control System utilizes standard Ethernet (CAT5/ 5e).
      - 1) Powered by Power over Ethernet, PoE Class 2 (6-watts).
      - 2) Requires ground wire.
  9. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
  10. Relevant Humidity Non-Condensing: 0 to 90 percent.
- B. Unison Control Series:
1. Product: Paradigm Architectural Control Processor by ETC, Inc.
    - a. Model P-ACP: Unison Paradigm Architectural Control Processor.
    - b. Standards Compliance: cULus Listed. CE Compliant.
    - c. Functional:
      - 1) Capacity:
        - a) Channels of Control: 1,024.
        - b) Stations: 128.
      - 2) System:
        - a) Net3 system interoperability including sACN.
        - b) Network Time Protocol for real-time clock synchronization supporting real and astronomical events.
        - c) Two physical DMX ports, each configurable as an input or output.
        - d) Configuration of DRd dimming operations.
        - e) 12 control processors per system.
          - 1) The addition of processors to a system proportionately increases the overall capacities.
      - 3) Serial Input/Output:
        - a) Eight-bit word length, parity selection and one or two stop bits.
        - b) Fully customizable input and output messages.
        - c) Bi-directional.
      - 4) Configuration Data:
        - a) Remote upload from a connected PC running LightDesigner or another connected Paradigm ACP.
        - b) Stored in removable solid-state memory for easy transfer to another Paradigm ACP.
      - 5) Local User Interface:
        - a) Control functionality for control channels, zones, fixtures, groups, presets, macros, walls, and sequences.
        - b) Ability to schedule timed events (add/edit/delete).
        - c) Transfer of configuration using removable media.
        - d) Transfer of configuration to and from touchscreen stations using removable media.
      - 6) User Access Controls: Two user accounts: Administrator and User. Local to each processor.
      - 7) Web User Interface:
        - a) Internal web server accessible via Ethernet port.
        - b) Activate and deactivate presets.
        - c) Schedule timed events (add/edit/delete).
        - d) Displays status information and log files.
        - e) Configuration of processor settings.
        - f) Supports configurable user login security options.
      - 8) Diagnostics: Standard and Critical Event logging.
      - 9) Stations:
        - a) Connected to a Paradigm processor via topology-free LinkConnect, or star-topology NetConnect.
        - b) Discovery and binding accomplished from the local user interface or LightDesigner.
      - 10) Operation:
        - a) Configurable DMX output refresh rate.
        - b) Support for 16-bit DMX attributes.

- c) User configurable arbitration for multiple internal and external source data.
  - d. Mechanical:
    - 1) For use in Unison DRd Rack Enclosure Series and Unison ERn Control Enclosure Series.
    - 2) Microprocessor-based, solid-state technology provides multi-scene lighting and building controls.
    - 3) Fully contained plug-in module with no discrete wire connections.
    - 4) Tool-free installation.
    - 5) Front-panel user interface with backlit LCD and alphanumeric button panel.
    - 6) RJ-45 Ethernet, Secure Digital (SD) and Universal Serial Bus (USB) media on front panel.
  - e. Electrical:
    - 1) No discrete wiring connections required for use in a dimming or control enclosure.
    - 2) Echelon LinkPower communications with remote devices, including button stations, button/fader stations, touchscreen stations, sensors, and third party LonMARK compliant products.
    - 3) Hot swappable.
    - 4) System configuration and programming stored in flash memory.
    - 5) Support of ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols.
    - 6) EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
    - 7) Two discrete ESTA DMX512A ports, configurable as input or output ports.
    - 8) User Datagram Protocol (UDP) messaging input and output for control of Paradigm or external systems.
    - 9) Four dry-contact closure inputs.
    - 10) Four contact-closure outputs rated 1 A at 30 Vdc.
  - f. Operating Temperature Range: 32-104 degrees F (0-40 degrees C).
  - g. Relevant Humidity Non-Condensing: 10 to 90 percent.
- 2. Product: Unison Paradigm Station Power Module Mk2 by ETC, Inc. For use with Unison DRd and ERn enclosures with Paradigm control. Addition of Station Power Module offers support for button, fader, and touchscreen stations.
  - a. Model P-SPM-E: Unison Paradigm Station Power Module Mk2.
  - b. Standards Compliance: cULus Listed. CE Compliant.
  - c. Functional:
    - 1) Provides Echelon LonTalk with LinkPower for up to 63 stations.
    - 2) Provides 24 V auxiliary power for interface and touchscreen stations.
    - 3) Provides 1,640 ft (500 m) of station bus from the ERn or DRd enclosure.
  - d. Mechanical:
    - 1) Designed for use in Unison Dimming (DRd) and Control (ERn) Series Enclosures.
    - 2) 18-gauge formed steel construction.
    - 3) Fine-textured, scratch-resistant, epoxy paint.
    - 4) Wall-mount and 19 in rack-mount variants available.
    - 5) Convection cooled.
    - 6) Fully contained plug in module with no discrete wire connections.
    - 7) Tool-free installation.
    - 8) Front-panel status indicators.
  - e. Electrical:
    - 1) No discrete wiring connections required for use in a DRd dimming or ERn control enclosure.
    - 2) Echelon LinkPower communications with remote devices, including button stations, button/fader stations, touchscreen stations, sensors, and third-party LonMARK-compliant products.
    - 3) 24 V Auxiliary power for interface and touchscreen stations.
  - f. Operating Temperature Range: 32 to 104 degrees F (0 to 50 degrees C).
  - g. Relevant Humidity Non-Condensing: 10 to 90 percent.
- 3. Product: Unison ERn External Control Enclosure by ETC, Inc.
  - a. Model ERn2-RM-xx Single Processor Control Enclosure-Rack Mount.
  - b. Standards Compliance: cULus Listed, CE Compliant.

- c. General:
    - 1) External Processing Enclosure designed for one or two control processors plus options and accessories.
    - 2) Full 2-year Warranty.
  - d. Mechanical:
    - 1) 18-gauge formed steel construction.
    - 2) Fine-textured, scratch-resistant epoxy paint.
    - 3) Wall-mount and 19-inch rack-mount variants.
    - 4) Rack-mount enclosure sizes: ERn2: 5U and ERn4: 8U.
    - 5) Rack mount offers connectorized rear panel for all wiring connections.
    - 6) Convection-cooled.
    - 7) Hinged, Locking door with limited access to control processor. Integral electrostatic air filter.
    - 8) Tool-free module removal and installation.
    - 9) 19-inch equipment-rack mount offers connectorized rear panel for all wiring connections.
    - 10) Wall-mount offers front access wiring terminations.
    - 11) Top, bottom, and side knockouts for conduit entry.
  - e. Electrical:
    - 1) External control enclosure rated for 100 V, 120 V, 230 V or 240 V UL single phase configurations, 3.5 A maximum draw at 120 V.
      - a) AC (single phase).
      - b) 24 Vdc (2-16 AWG).
      - c) LinkConnect.
      - d) Two configurable DMX512A ports.
      - e) RS232 Bi-directional serial.
      - f) Cat5/5e UTP Ethernet.
      - g) Contact I/O, 4in/4out (14 to 26 AWG).
        - 1) Contact output rated 1 A at 30 Vdc.
    - 2) Contractor-supplied input and control wiring.
    - 3) Factory-provided connectors for wiring terminations.
  - f. Operating Temperature Range: 32 to 104 degrees F (0 to 50 degrees C).
  - g. Relevant Humidity Non-Condensing: 10 to 90 percent.
- C. Unison Heritage Control Series:
- 1. Product: Unison Heritage Button Station by ETC, Inc.
    - a. Standards Compliance: cULus Listed. CE Compliant.
    - b. Mounting: Flush, Surface.
    - c. Functional:
      - 1) Button and key switch functions: preset selection, record mode activation, station lockout, raise, lower, macro activation, zone on/off control, timed-event override, and wall open/close or toggle.
      - 2) Custom button functionality programmable via LightDesigner configuration software.
      - 3) Programmable electronic lockout levels.
      - 4) Allows for programming of individual lockout levels.
    - d. Mechanical:
      - 1) Gangable for custom applications.
      - 2) Enclosed electronics assembly and faceplate included.
      - 3) Cantilevered switch arrays with removable caps.
      - 4) No visible means of attachment.
      - 5) Flush-mount in industry standard back box, RACO 690 or equivalent.
      - 6) Surface-mount backboxes available from manufacturer.
      - 7) Constructed of injection-molded, ABS plastic.
      - 8) Indelibly marked legends in contrasting colors.
      - 9) Integral RGB LED response indicator for each button.
      - 10) Integrated IR receiver.
      - 11) Unison Heritage Locking Cover.
    - e. Electrical:
      - 1) Connect via Echelon LinkPower control network utilizing low-voltage Class II wiring.
      - 2) Topology-free and polarity-independent wiring over Belden 8471 and one No. 14

- ESD drain wire.
  - a) Wiring may be bus, loop, homerun, or any combination of these.
- 3) All station terminations are connectorized.
- f. Operating temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
- g. Relative Humidity, Non-Condensing: 30 to 90 percent.
- 2. Product: Unison Heritage Fader Stations.
  - a. Standards Compliance: cULus Listed. CE Compliant.
  - b. Functional:
    - 1) Operate default or custom system functions, including preset selection, manual mode activation, record mode activation, station lockout, raise, lower, sequence control, zone on/off, room combine, macro activation and timed-event override.
    - 2) Fader functions include master, zone, fade rate, or preset.
    - 3) Custom button and fader functionality programmable via LightDesigner configuration software.
    - 4) Programmable electronic lockout levels.
    - 5) Buttons allow programming of individual lockout levels.
  - c. Mechanical:
    - 1) Enclosed electronics assembly.
    - 2) Faceplate with no visible means of attachment.
    - 3) 45 mm slide potentiometer faders and cantilevered switch arrays with removable caps.
    - 4) Flush-mount in industry-standard backboxes.
    - 5) Surface mount back boxes available from manufacturer.
    - 6) Constructed of injection-molded, ABS plastic.
    - 7) Indelibly marked legends in a contrasting color
    - 8) Integral RGB LED response indicator for each button and fader.
    - 9) Integrated IR receiver.
    - 10) Unison Heritage Locking Cover.
  - d. Electrical:
    - 1) Connect via Echelon LinkPower control network utilizing low-voltage Class II wiring.
    - 2) Topology-free and polarity-independent wiring over Belden 8471 or equivalent, and one No. 14 ESD drain wire.
    - 3) Wiring may be bus, loop, homerun, or any combination of these.
    - 4) All station terminations are connectorized.
  - e. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
  - f. Relative Humidity, Non-Condensing: 30 to 90 percent.

## 2.9 ARCHITECTURAL CONTROLS - EMERGENCY CONTROL PRODUCTS

- A. Product: DMX Emergency Bypass Controller by ETC, Inc. Where required to trigger special-purpose lighting presets and bypass normal lighting controls during emergency or panic situations.
  - 1. Model DEBC-1: DMX Emergency Bypass Controller, 1-output.
  - 2. Capable of overriding a single universe of DMX512 control signals from "Normal" to "Bypass" when a trigger signal is detected via a contact closure trigger input.
    - a. Output to a single DMX output or up to six optically isolated DMX outputs.
    - b. Poll bypasses trigger input after a power loss and react upon start up.
    - c. Recalled immediately on restart if trigger is also applied at restart.
  - 3. Capable of recording a single DMX preset (snapshot) of 512 channels for recall during "Bypass" mode.
  - 4. Internally accessible, labeled DIP switches for configuration of:
    - a. DMX Record Mode: 512 channels. Selected channels, snapshot.
    - b. Contact Input Type: Normally open (default). Normally closed.
    - c. Wait Time for Restore incoming DMX; Bypass Trigger Removed: 0 Seconds (default). 10 seconds wait. 30 second wait. 10-minute wait.
  - 5. Single Bypass Input Using Two Input Modes:
    - a. Bypass Triggering: Via a maintained contact input configurable for normally open (N.O.) or normally closed (N.C.) operation.
    - b. Contact Input: 12 Vdc wet input for interface with fire alarm or secondary triggering systems.
  - 6. Mechanical:

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- a. Surface Mounted Enclosure. Removable Front Cover: 16-gauge, formed steel.
- b. Single Bi-Color LED Indicator: Visible from exterior of enclosure.
  - 1) Normal State: Green light when Power and DMX are present.
  - 2) Off indicates Power or DMX are not present.
  - 3) Bypass State: Red light. Includes bypass input contact trigger or 'test' active.
- c. Test Button: Front enclosure accessible without removing panels.
  - 1) Triggers bypass state if it is held down. Releases bypass state upon button release.
    - a) Button: Momentary only. Recessed to prevent accidental triggering.
- d. Single, internally accessible button for DMX Record (snapshot) with an indicator LED for record action.
  - 1) Record Button: Momentary only and held for 3 seconds before activation to prevent accidental recording.
  - 2) LED indicator: Flashes rapidly when record function is active and illuminate steady when record function is complete.
- 7. Electrical: Internally pre-wired by Manufacturer.
  - a. Contractor to provide input feed and control wiring to terminals.
    - 1) Input Power: 100 to 277 V, 50/60 Hz, 150 mA maximum current.
  - b. Labeled terminations for two 24 to 10 AWG solid or stranded power wires.
  - c. One Grounding Lug for 24 to 14 AWG solid or stranded ground wire.
  - d. Labeled, socketed termination connections for DMX Input and Output wiring.
    - 1) Terminations support Belden 9729, 1583A Category 5 cable, or equivalent.
  - e. Labeled, socketed termination for bypass contact input.
    - 1) Termination to support two, 30 to 12 AWG low-voltage wires.
    - 2) Bypass Input: To maintain normally open (N.O.) or normally closed (N.C.) dry contact input.
    - 3) Wet Contact Input: 12 Vdc for fire alarm system interface.
    - 4) Socketed DMX transceiver chips.
      - a) Spare chip in labeled, inactive socket.
  - f. Internally switch from normal DMX input (pass through) to bypass DMX output using electromechanical relays when triggered.
    - 1) Non-Volatile Memory: For storage of single recorded sequence of 512 channels.
      - a) Recorded sequence to persist through power outages.
      - b) Default Sequence: 512 channels at "full" if no sequence is recorded.
    - 2) DMX Baud Rate: "Slow," 20 packets per second for increased compatibility during bypass DMX output.
  - g. Two versions capable of output to a single DMX line or up to six optically isolated DMX lines.
  - h. Standards Compliance: UL and cUL Section 924 Listed for interaction with similarly listed products.
- 8. Room Operating Temperature: 32 to 104 degrees F (0 to 40 degrees C).
  - a. Humidity non-condensing: 10 to 95 percent.
- B. Product: Emergency Bypass Detection Kit by ETC, Inc. To detect loss of normal power and trigger special-purpose lighting presets.
  - 1. Model EBDK: Emergency Bypass Detection Kit.
  - 2. Standards Compliance: UL and cUL Section 924 Listed.
  - 3. Surface Mounted Enclosure. Removable Front Cover: 16-gauge, formed steel.
    - a. Finish: Fine textured, scratch-resistant, powder coat paint.
  - 4. Breaker: 3 pole, 10 amp for local over-current protection and simulation of normal power loss.
  - 5. Lockable Door: Limits access to over-current protection breaker.
  - 6. Components to be properly treated and finished.
  - 7. Discrete high and low voltage wiring compartments with voltage barrier.
  - 8. Electrical:
    - a. Input Power: 100 to 277 V. Field configurable for single-phase, bi-phase, and three-phase operation without additional components.
    - b. Phase Loss Detection Circuitry: 0.5 second delay to prevent nuisance tripping.
    - c. Integrated Circuit Breaker: Over-current protection and normal power loss simulation.
    - d. Isolated Outputs: For connection to multiple dimming products simultaneously.
      - 1) Three Isolated Contacts: Each support connection of four dimming products.
    - e. Pre-wired by Manufacturer. Contractor to provide input feed and control wiring.
    - f. Control Wire Connections: Terminated via factory provided connectors.



- 1) Support 12 to 22-gauge wiring.
- 2) Emergency Lighting Input: Support load shedding.
- g. Bypass Detection Kit: Proves a normally closed input for interface with fire alarm systems. UL and cUL Section 924 Listed for interaction with similarly listed dimming and switching panels.
9. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
  - a. Humidity non-condensing: 10 to 90 percent.
- C. Product: UL924 Emergency Lighting Device to be the Automatic Load Control Relay by ETC, Inc. Allows standard lighting control devices to control emergency lighting in conjunction with normal lighting in any area within a building.
  1. Model ALCR-PP-Mk2: Automatic Load Control Relay Power Pack.
  2. Standards Compliance: UL and cUL listed to UL924 standard and labeled for connection to normal and emergency lighting power sources.
  3. Control of emergency lighting fixtures in tandem with normal lighting in an area while ensuring emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Independent for each controlled area and will not require a generalized power failure for proper operation.
  4. Two Form Factors Available:
    - a. ALCR-PP-Mk2: Power pack model. Constructed of 94-V-0 plastic enclosing high voltage components and mounts to 1/2 inch (13 mm) electrical junction box knock out using a thread nipple and retaining nut.
      - 1) Flying lead connections for power and 0 to 10 V.
      - 2) Terminal connections for DMX.
    - b. ALCR-DIN: Din rail mount with terminal connections
  5. Breaks data circuit upon loss of normal power supporting fixtures that switch to full brightness upon loss of an incoming data signal.
    - a. ALCR-PP-Mk2: Supports DMX and two circuits of 0 to 10 V pass-through for intensity and color temperature control.
  6. Capable of switching 20-amp emergency ballast loads at 120-277 Vac, 60 Hz, or 10-amp tungsten loads at 120 Vac, 60 Hz.
  7. Universal Rated Voltage Input: For normal power sense and normal switched power at 120-277 Vac, 60 Hz.
  8. Integral Momentary Test Switch: Press and hold switch forces emergency mode and turns on emergency lighting. Releasing switch returns unit to normal operation unless optional "return to normal" delay has been programmed.
  9. Dedicated leads and 24 Vdc source for connection to remote triggering device such as test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure.
    - a. Remote Trigger: Install no further than 1000 ft wire distance from ALCR. Breaking loop or contact between the terminals forces and holds emergency lighting on until loop is closed.
    - b. Integral LED indicator indicates unit's current remote activation status.
  10. Status and Remote LEDs indicate device state.
    - a. Status LED: Indicates whether emergency output is required and active. Lit Green: Normal power is present. Lit Red: Emergency output is active due to remote activation or due to loss of normal power.
    - b. Remote LED: Lit Amber: Indicates normal lighting control is commanding emergency light to be active. Unlit Dark: Normal control is open (off).
  11. Device's Normal Power Input Lead: Connected to line side of control device such that any upstream fault causing a loss of power, including tripping of branch circuit breaker, will force unit into emergency mode and turn on emergency lighting.
  12. Programmable "Return to Normal" Delay: Keeps lights on for a period of 15 minutes after normal state returns such that any egress in progress can complete before a normally dark area is allowed to return to its dark state. Programmable delay options include instant, 10 seconds, 30 seconds, 10 minutes, and 15 minutes.
  13. Zero crossing circuitry to protect relay contacts from damaging effects of inrush current generated by switching electronic ballast loads.
  14. Unit Housing: UL2043 plenum rated and equipped with flying leads.

## 2.10 ENTERTAINMENT LUMINAIRES (4WRD SERIES)

### HIGH SCHOOL AUDITORIUM AND BLACKBOX THEATRICAL LIGHTING SYSTEM

- A. Basis of Design: Source 4WRD PAR/PARNet as manufactured by ETC Inc. Transforms Source 4WRD II LED or S4WRD Color II LED engine into a soft light.
1. Fixture bodies for use with Source 4WRD II or SrWRD Color II LED retrofit.
  2. Works just like a Source Four PAR or PARNet, using the same accessories.
  3. Brighter than the 750 W HPL versions.
  4. Uses same Source 4WRD II LED or Source 4WRD Color II retrofit as the Source 4WRD ellipsoidal.
  5. Standards Compliance:
    - a. cULus.
    - b. CETL when used with ETC Source 4WRD LED Retrofit.
  6. Source:
    - a. S4WRD II or S4WRD Color II LED sold separately.
  7. Optical:
    - a. Beam Angle Range: PAR: 10 to 36 degrees. PARNet: 13 to 30 degrees.
    - b. Gate Size: N/A.
    - c. Aperture Size: 7 inches.
    - d. Pattern Projection: No.
    - e. Pattern Size: N/A.
    - f. PAR: AR coated flat lens. PAR lenses sold separately.
    - g. PARNet: ships with PARNet lenses.
  8. Physical: IP Rating: IP-20.
    - a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
    - b. Mounting Options: Yoke.
    - c. Included Accessories: Color frame.
    - d. Includes S4WRD mounting post. Required S4WRD II or S4WRD Color II LED available separately.

## 2.11 ENTERTAINMENT LUMINAIRES (COLORSOURCE)

- A. Basis of Design: ColorSource CYC as manufactured by ETC Inc. A dedicated cyclorama fixture for creating beautiful, smooth washes of light on a cyclorama or wall. Five-color mix of red, green, blue, lime, and indigo for expanded range and color control.
1. Standards Compliance:
    - a. Listed: cETLus, UL 1573, and CSA C22.2 No. 166.
    - b. Compliance: CE and EAC.
  2. Source:
    - a. LED Details: 42 Lumileds LUXEON C LEDs.
    - b. Max Lumens: 4117.
    - c. Lumens per Watt: 31.
    - d. L70 rating: greater than 50,000 hours.
  3. Color:
    - a. Colors Used: Red, Green, Blue, Indigo, and Lime.
    - b. Color Temperature Range: Range.
    - c. Calibrated Array: Yes.
    - d. Red Shift: No.
  4. Optical:
    - a. Beam Angle Range: DMX-512 via 5-pin XLR connector
    - b. Gate Size: N/A.
    - c. Aperture Size: N/A.
    - d. Pattern Projection: No.
    - e. Pattern Size: N/A.
    - f. Camera Flicker Control/Hz Range: Default: 1,200 Hz. RDM: 25,000 Hz.
    - g. The ColorSource CYC has a built-in accessory for spill control.
  5. Control:
    - a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX.
    - b. Modes (Footprint): 5 channels: IRGBS (5). Direct: IRGBILS (7). 1 channel: (1). RGB: RGB (3).
    - c. RDM Configuration: Yes.
    - d. User Interface Type: 7-segment address display, local level control via UI.
    - e. Local Control: Yes.

- f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
      - g. FixtureLink support: Yes.
    - 6. Electrical:
      - a. Voltage: 100 to 230 Vac, 50 to 60 Hz.
      - b. Input Method: PowerCON in and thru.
      - c. Inrush First Half-Cycle: 39 A at 120 V. 74 A at 240 V.
      - d. Wattage (Typical/Standby): 133 / 1.4 W at 120 V. 116 / 1.2 W at 230 V.
      - e. Current Draw: 1.11 A at 120 V. 1.11 A at 230 V.
    - 7. Thermal: Operating Temperature: 32 to 104 degrees F.
      - a. Fan: No. db Range: 18.5 dBA average at 39 inches.
      - b. Droop Compensation: Yes.
      - c. BTUs/hour: 453.
    - 8. Physical: IP Rating: IP-20.
      - a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
      - b. Mounting Options: Yoke and floor.
      - c. Included Accessories: Hanging yoke, power cable.
- B. Basis of Design: ColorSource Linear as manufactured by ETC Inc. Combines output o with a sleek linear design creating a strip light. Uses RGB-L or bi-white color system.
  - 1. Standards Compliance:
    - a. Listed: cETLus, UL 1573, and CSA C22.2 No. 166.
    - b. Compliance: CE and EAC.
  - 2. Model ColorSource Linear 2. 1 meter long. Two cells of control.
  - 3. Source:
    - a. LED Details: 40 Lumileds LUXEON Z LEDs per segment.
    - b. L70 Rating: 55,000 hours. Standard and DB.
  - 4. Color:
    - a. Color temperature Range: Standard and DB: Color mixing fixture.
    - b. Calibrated Array: Yes.
    - c. Red Shift: No.
  - 5. Optical:
    - a. Beam Angle Range: 15.6 degrees.
    - b. Gate Size: N/A.
    - c. Aperture Size: 7.5 inches.
    - d. Pattern Projection: No.
    - e. Pattern Size: N/A.
    - f. Camera Flicker Control/Hz Range: Default: 1,200 Hz. RDM: 25,000 Hz.
  - 6. Control:
    - a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.
    - b. RDM Configuration: Yes.
    - c. User Interface Type: 7-segment address display, local level control via UI.
    - d. Local Control: Yes.
    - e. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
    - f. Fixture-to-Fixture Control: Yes.
    - g. 15-bit virtual dimming engine.
  - 7. Electrical:
    - a. Voltage: 100 to 240 Vac, 50 to 60 Hz.
    - b. Input Method: PowerCON in and thru.
    - c. Inrush First Half-Cycle: Linear 1 / Linear 2 / Linear 4.
      - 1) 35 A / 35.6 A / 67.5 A at 120 V. 49 A / 85.6 A / 153 A at 240 V.
    - d. Wattage (120 Vac / 240 Vac): Linear 2: 218 / 213.
    - e. Current Draw Linear 2: 1.82 A at 120 VAC. 0.91 A at 240 Vac.
  - 8. Thermal: Operating Temperature: 32 to 104 degrees F.
    - a. Fan: Yes. Not controllable.
    - b. db Range Average at 39 inches: Linear 2: 28.4 dBA.
    - c. Droop Compensation: Yes.
    - d. BTUs/hour: (120 Vac / 240 Vac).
      - 1) Linear 2: 743.82 / 726.76.
  - 9. Physical: IP Rating: IP-20.
    - a. Materials: Die-cast alum. and plastic. Colors: Black, white, silver, or custom.
    - b. Mounting Options: Yoke. 1 cell option. Trunnions.
    - c. Included Accessories: Power cable and trunnions.

- C. Basis of Design: ColorSource Spot V and ColorSource Spot VXT, manufactured by ETC Inc. Brings together a five-color light engine with the build-quality and support of an ETC product. Uses a mix of red, green, blue, indigo and lime LED emitters. ETC optics, adapters, and accessories.
1. Standards Compliance:
    - a. Listed: cETLus, UL 1598, UL 924, CSA C22.2 No. 250.0.
    - b. Compliance: CE.
  2. Model ColorSource Spot V with shutter barrel, black.
  3. Source:
    - a. LED Details: 60 Lumileds LUXEON Rebel and LUXEON C LEDs.
    - b. Max Lumens: 9300.
    - c. Lumens per Watt: 47.2.
    - d. L70 Rating: Greater than 54000 hours.
  4. Colors:
    - a. Colors Used Spot: Red, green, blue, indigo, lime.
    - b. Color temperature Range: Color mixing.
    - c. Calibrated Array: Yes.
    - d. Red Shift: No.
  5. Optical:
    - a. Beam Angle Range: 5 to 90 degrees. Swappable lens tubes.
    - b. Gate Size: 80 mm.
    - c. Aperture Size: 6.25 to 14 inches depending on lens tube.
    - d. Pattern Projection: Yes.
    - e. Pattern Size: A or B.
    - f. Camera Flicker Control/Hz Range: 5 kHz and 25 kHz.
  6. Control:
    - a. Input Method:
      - 1) DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.
      - 2) City Theatrical Multiverse. Protocols: DMX512, RDM
    - b. NFC Configuration: Yes, via Set Light app.
    - c. RDM Configuration: Yes.
    - d. User Interface Type:
      - 1) ColorSource Spot V: 7-segment 3 button interface.
    - e. Local Control: Yes. (ColorSource Spot V only)
    - f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
    - g. Fixture-to-Fixture Control: Yes.
    - h. 15-bit virtual dimming engine.
  7. Electrical:
    - a. Voltage: 100 to 240 VAC, 50 to 60 Hz.
    - b. Input Method: powerCON True1 TOP in and thru.
    - c. Inrush First Half Cycle: 55 A at 120 V. 59 A at 240 V.
    - d. Fixtures per Circuit:
      - 1) Eight. (R20 module or similar).
    - e. Power Draw
      - 1) Wattage: Typical: 197. Standby: 2 at 120 V.
      - 2) Current Draw at 120 Vac: Typical: 1.65 A. Standby: 0.08 A.
  8. Thermal: Operating Temperature: 32 to 104 degrees F.
    - a. Fan: Yes. Controllable.
    - b. Droop Compensation: Yes.
    - c. BTUs/hour: 671.77.
  9. Physical: IP Rating: ColorSource Spot V: IP-20. ColorSource Spot VXT: IP-65
    - a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
    - b. Mounting Options: Yoke.
    - c. Included Accessories: Hanging yoke, 39-inch power cable, soft-focus diffuser in an A-size gobo holder.
- D. Basis of Design: ColorSource Fresnel V as manufactured by ETC Inc. An affordable high quality Fresnel wash fixture with motorized zoom. Uses RGBIL color system.
1. Standards Compliance:
    - a. Listed: cETLus, UL 1573, CSA C22.2 No. 166.
    - b. Compliance: CE and EAC.
  2. Model ColorSource Fresnel V: Black

3. Arrays:
  - a. RGBIL (Red/Green/Blue/Indigo/Lime).
4. Source:
  - a. LED Details: 44 Lumileds LUXEON C LEDs
  - b. Max. Lumens: 5,300.
  - c. Lumens per Watt: 36.
  - d. L70 rating: Greater than 54,000 hours.
5. Color:
  - a. Color temperature Range: Color mixing.
  - b. Calibrated Array: Yes.
  - c. Red Shift: No.
6. Optical:
  - a. Beam Angle Range: 13 to 44 degrees.
    - 1) Motorized zoom.
  - b. Gate Size: N/A.
  - c. Aperture Size: 7"
  - d. Pattern Projection: No.
  - e. Pattern Size: N/A.
  - f. Camera Flicker Control/Hz Range: Default: 5kHz. RDM: 25,000 Hz.
7. Control:
  - a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM, City Theatrical Multiverse, NFC.
  - b. RDM Configuration: Yes.
  - c. NFC Configuration: Yes
  - d. User Interface Type: 7-segment 3 button, single encoder interface.
    - 1) Encoder controls local motorized zoom.
  - e. Local Control: Yes.
  - f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
  - g. Fixture-to-Fixture Control: Yes.
  - h. 15-bit virtual dimming engine.
8. Electrical:
  - a. Voltage: 100 to 240 Vac, 50 to 60 Hz. Input Method: PowerCON True1 in and thru.
  - b. Inrush First Half-Cycle:
  - c. Fixtures per Circuit:
    - 1) 20 Amp Power-Thru Connector: Quantity of 8.
    - 2) R20 Module or Similar: Quantity of 9.
    - 3) Wattage at 120 Volts: 148.4 W.
    - 4) Wattage at 240 Vol: 147 W.
    - 5) Current Draw at 120 Volts: 1.28 Amps.
    - 6) Current Draw at 240 Volts: 10.70 Amps.
9. Thermal: Operating Temperature: 32 to 104 degrees F.
  - a. Fan: Yes. Not controllable. dB Range: 22.9 dBA average at 39 inches.
  - b. Droop Compensation: Yes.
10. Physical: IP Rating: IP-20.
  - a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
  - b. Mounting Options: Yoke or floor stand.
  - c. Included Accessories: Power cable and hanging yoke.
  - d. Seven-segment, three-button Interface.

## 2.12 ENTERTAINMENT FOLLOWSPOT

- A. Basis of Design: CantoUSA Astro 600 LED Follow spot 3000K.
  1. Astro 600 3200K Follow spot Fixture with 8–22-degree zoom
  2. Iris
  3. Lamp (LED light Engine with 10-year warranty on the light array)
  4. Tripod Stand
  5. 6 Color Boomerang
  6. Power Cable w/ 15A Edison
  7. 7.25" Round Gel Pack (5 colors)
  8. 28mm spigot

### HIGH SCHOOL AUDITORIUM AND BLACKBOX THEATRICAL LIGHTING SYSTEM

9. Provide with optional tripod casters.
10. Provide (2) Follow spots for Auditorium.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation of this equipment shall only be performed by manufacture approved and factory trained theatrical rigging installers. Installation shall be performed in a workmanlike manner and shall strictly adhere to the standards of these specifications and manufacture's installation requirements. Where necessary, the installer shall adjust to accommodate unforeseen impediments to installation. The completed work must achieve all electrical, safety and appearance requirements as established in these specifications. Install all new equipment in compliance with national and local electrical codes. The auxiliary equipment required to make this installation comply with codes, even if not listed in the specification, is the responsibility of the contractor.
- B. All wiring shall be done in a craftsman-like manner. When conductors must be spliced to extend length, it shall be done with a terminal strip or suitable type compression fittings.
- C. Equipment shall be kept clear of all metal shavings, wire scraps, and miscellaneous trash. Any abandoned holes in the floor shall be patched.
- D. Any existing conduit emanating from the floor shall be dressed in such a manner as to eliminate any trip hazard. Conduits shall be re-routed or terminated into wireways to insure a neat installation.
- E. All equipment shall be installed in compliance with applicable local and national codes. It shall also be installed in accordance with the manufacturer's recommendations. Prior to initial energizing, a factory certified technician shall inspect the system and any errors shall be corrected.
- F. Pipes positions shall be rigidly fixed, and conduit shall be flexible, following the hanging points. Conduit shall not obstruct the pipe: it shall be possible to add additional portable fixtures anywhere on the pipe position without obstruction.
- G. Provide all lighting fixtures and accessories as indicated or required. All portable fixtures shall be unboxed, lamped, hung on pipe positions, tested, and focused for an even stage wash. Safety cables shall be installed around fixture yoke and pipe position. Data cables shall be installed to connect all fixtures to DMX as needed, with excess cable tied neatly to pipe.
- H. Portable lighting console and cables shall be tested and provided for the system energization and training and then turned over to the Owner.
- I. Work shall be performed in accordance with OSHA and local codes.
- J. On site welding shall only be performed per AWS D1.1 standards and with advanced approval from the Architect and Owner's representative.

#### 3.2 COMMISSIONING

- A. Operational Tests: Energize lighting controls systems, program controls, and check controlled outlets for light levels. Program test scenes so every fixture is tested throughout its operating range. Check programmed function at each control station. Adjust components and revise installation to correct deficiencies.
- B. Correct deficiencies and retest deficient items. Verify by the system tests that specified requirements are met.

END OF SECTION



SECTION 26 56 67

SPORTS FIELD LIGHTING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for athletic fields using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications. Basis of design manufacture: Musco.
- C. The sports lighting will be for the following venues:
  - 1. Tennis
- D. The primary goals of this sports lighting project are:
  - 1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels shall be guaranteed to not drop below specified target values for a period of 25 years from date of delivery of equipment to the site.
  - 2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators, and neighbors.
  - 3. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be the responsibility of the manufacturer as indicated and included at no additional cost to the Owner for the duration of the warranty.
  - 4. Control and Monitoring: Provide a remote on/off control system for the lighting system. Fields shall be proactively monitored to detect luminaire outages over the 25-year life cycle. All communication and monitoring costs for 25-year period shall be included at no additional cost to the Owner.
- E. All lighting designs shall comply with local lighting ordinances.

1.2 SPECIFICATION COMPLIANCE REVIEW

- A. Provide a complete written, item-by-item specification review indicating compliance or deviation in full description.
- B. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification with the product data.

1.3 WARRANTY AND GUARANTEE

- A. 25-Year Warranty: Manufacturer shall provide a signed warranty covering the entire system for 25 years from the date of delivery to the site. The warranty shall guarantee specified light levels. The manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover acts of God, weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or products made by other manufacturers.
- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the

SPORTS FIELD LIGHTING SYSTEM



usage of any field is materially impacted. Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is materially impacted. In event of an outage, Owner shall verify for the manufacturer that power is available to each lighting circuit controller, fuses, and lighting contactors.

## PART 2 – PRODUCTS

### 2.1 ILLUMINATION PERFORMANCE REQUIREMENTS

- A. **Illumination Levels and Design Factors:** Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors including but not limited to dirt depreciation and optical material deterioration shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period. Due to various dimensions of some athletic fields the actual quantity of grid points may vary, however the grid spacings shall be taken over the entire playing surface and the exact quantity adjusted accordingly.

Area of Lighting: Average annual usage	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Minimum Grid Points	Grid Spacing
Tennis	50 foot-candles	1.5:1.0	60/court	20' x 20'

- B. **Color:** The lighting system shall have a color temperature of 4000K-5700K and a minimum CRI of 75.
- C. **Mounting Heights:** To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Provide mounting heights as required based on pole locations and setback from the field of play. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.
- D. **Aiming of any luminaire** shall not be greater than 60 degrees from nadir.
- E. **Center of luminaire cluster height at top of light poles:** Typical average mounting height of a light cluster  $H = [(1/3 W) + SB] \times \tan 30$ . Width (W) = width of playing surface from foul line or inbound/outbound line to the opposite foul line or inbound/outbound line in the direction of the principal aiming of respective light standard pole. Pole Set Back (SB) = the distance from the nearest foul line or inbound/outbound line to the proposed light standard pole location.
- F. Unless indicated otherwise the center of an individual luminaire cluster's mounting height shall be as recommended by IES due to pole set back but in no case, shall any aiming angle of any luminaire aimed to the sports field exceed 60 degrees from nadir.

### 2.2 ENVIRONMENTAL LIGHT CONTROL

- A. **Light Control Luminaires:** All luminaires shall utilize spill light and glare control devices including, but not limited to, optical lensing, internal shields, louvers, or external shields.
- B. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years' experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be

included with the photometric report.

## 2.3 SPORTS LIGHTING SYSTEM CONSTRUCTION

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested prior to shipment.
- B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- C. System Description: Lighting system shall consist of the following:
1. Galvanized steel poles with maintenance platform/cage, climbing pegs, and cross-arm assembly.
  2. Non-approved pole technology:
    - a. Square static cast concrete poles will not be accepted.
    - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.
  3. Lighting systems shall use concrete foundations.
    - a. For a foundation using a pre-stressed concrete base embedded in concrete backfill, the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
    - b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or reinforced pier design pole, erection may occur after 7 days, or after a concrete sample from the same batch achieves a specified strength approved by the structural engineer.
  4. Manufacturer shall supply all LED drivers and supporting electrical equipment
    - a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum NEMA 3RX enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure shall be located in the enclosure.
  5. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2\_2002.
  6. Wire harness shall be complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
  7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
  8. Control cabinet shall provide remote on-off control and monitoring of the lighting system.
  9. Manufacturer shall provide lightning protection and grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
    - a. Integrated grounding via concrete encased electrode grounding system.
    - b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

- D. Safety: All system components shall be UL listed for the appropriate application.

## 2.4 ELECTRICAL

- A. Electric Power Requirements for the Sports Lighting Equipment:
  - 1. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.
- B. Equipment requiring electrical distribution more than that indicated or required by the basis of design shall be provided by the contractor at no additional cost to the Owner.

## 2.5 STRUCTURAL PARAMETERS

- A. Wind Loads: Wind loads shall be based on the latest published edition of the International Building Code and all local code requirements. Wind loads shall be calculated using ASCE 7-10, an ultimate design wind speed of 120 mph and exposure category C.
- B. Manufacturer Pole Structural Design: The stress analysis and safety factor of the poles shall conform to the latest published edition of AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-5).
- C. Manufacturer Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If a geotechnical report is not utilized, the foundation design shall be based on class 5 soils.
- D. Manufacturer Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

## 2.6 CONTROL

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires. Contactors shall be rated 60A/3P to utilize existing 40 Amp feeder circuits.
- B. Lighting contactor cabinet(s) constructed of minimum NEMA Type 3RX aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto (momentary ON/OFF reverting to the AUTO position) rotary (non-keyed) selector switches shall be provided. The system shall be programmed for manual ON/OFF operation only.
- C. Remote Lighting Control System: System shall allow Owner and users with a security code to schedule on/off system operation via a web site, phone, fax, or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
  - 1. The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute "early off" commands. The scheduling tool shall be capable of setting curfew limits.
  - 2. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.
- D. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- E. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation, and service. Mobile applications shall be provided suitable for IOS, and Android devices.
- F. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field

lighting system that is readily accessible to the owner.

1. Cumulative hours: shall be tracked to show the total hours used by the facility
2. Report hours saved by using early off and push buttons by users.

- G. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

## 2.7 CONTROL OF EXISTING NON-MUSCO LIGHT POLES

- A. Provide three additional controlled 60A/3P lighting contactors for control of existing HID tennis court lighting. Include spare cabinet space as needed for future equipment/controls for monitoring of these three additional contactor circuits for future HID replacement to Musco LED.

## PART 3 – EXECUTION

### 3.1 SOIL QUALITY CONTROL

- A. It shall be the Contractor's responsibility to notify the Architect/Engineer/Owner immediately if unforeseen soil conditions exist other than those on which the foundation design is based or indicated in the project's Geotechnical Report, or if the soil cannot be readily excavated.
1. Provide engineered foundation embedment design by a registered engineer in the State where the project is located for soils other than specified soil conditions.
  2. Provide additional materials required to achieve alternate foundation design.
  3. Excavate and remove from the site materials other than normal soils, such as rock, caliche, etc.

### 3.2 FIELD QUALITY CONTROL

- A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- B. Field Light Level Accountability
1. Light levels shall be guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 Years.
  2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of substantial completion or commissioning of the lighting system and shall also utilize the Owner's light meter in the presence of the Owner at the Owner's request.
  3. The contractor/manufacturer shall make all changes needed to bring the fields back to compliance for light levels and uniformities. Contractor/Manufacturer shall be held responsible for any damage to the fields during these repairs and make repairs to the satisfaction of the Owner at no additional cost.
- C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including foot-candles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Contractor/Manufacturer shall make all adjustments required to meet specifications and satisfy the Owner at no additional cost to the Owner.

END OF SECTION

# SUBMITTAL INFORMATION

## Design Submittal Data Checklist and Certification

*All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements*

Included	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by, and other pertinent data b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), or home plate for baseball / softball fields. Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of meter above field surface e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance and uniformity gradient; number of luminaires, total kilowatts, average tilt factor; light loss factor. f. Alternate manufacturers shall provide both initial and maintained light scans using a maximum 0.70 Light Loss Factor to calculate maintained values.
	C	Off Field Lighting Design	Lighting design drawings showing spill light levels in footcandles as specified in section 1.3 A.
	D	Photometric Report	Provide photometric report for a typical luminaire used showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.
	E	Life Cycle Cost calculation	Document life cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires, maintenance cost for the system including spot lamp replacement, and group relamping costs. All costs should be based on 25 Years.
	F	Luminaire Aiming Summary	Document showing each luminaire's aiming angle and the poles on which the luminaires are mounted. Each aiming point shall identify the type of luminaire.
	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Texas.
	H	Control and Monitoring	Manufacturer shall provide written definition and schematics for automated control system to include monitoring. They will also provide examples of system reporting and access for numbers for personal contact to operate the system.
	I	Electrical distribution plans	If bidding an alternate system, manufacturer must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Texas.
	J	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed per specification for 25 years. Constant light systems shall provide independent 3 <sup>rd</sup> party test data stamped by a registered engineer.
	K	Warranty	Provide written warranty information including all terms and conditions.
	L	Project References	Manufacturer to provide a list of project references of similar products completed within the past three years.
	M	Product Information	Complete set of product brochures for all components, including a complete parts list and UL Listings.
	N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications.
	O	Compliance	Manufacturer shall sign off that all requirements of the specifications have been met at that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in item N – Non-Compliance

## SPORTS FIELD LIGHTING SYSTEM

Manufacturer:                      Signature:  
Contact Name:                      Date: \_\_\_\_/\_\_\_\_/\_\_\_\_



SECTION 27 01 00

OPERATION AND MAINTENANCE (O&M) MANUALS  
OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three (3) electronic copies, on separate devices (USB Flash Drive or some type of pre-approved solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.
- D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.
- E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.
- F. The final submitted manual shall include a sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
  - 1. Table of Contents for each element
  - 2. Contractor information
  - 3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant's stamp of acceptance.
  - 4. All parts and maintenance manuals for items of equipment
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates)
  - 9. Control operations / equipment wiring diagrams
  - 10. Coordination Drawings
  - 11. Schedule of Speakers, Amplifiers, Sound Equipment, Etc.
  - 12. Schedule of Handsets and other Peripheral Devices, Etc.
  - 13. Schedule of Cable, Jacks, Outlets, Etc.
  - 14. Access Control Door Schedules
  - 15. Video Surveillance Camera Schedules
  - 16. Other required operating and maintenance information that are complete.
  - 17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
  - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.

OPERATION AND MAINTENANCE (O&M) MANUALS OF COMMUNICATIONS SYSTEMS



2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.
- D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.
- F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

## PART 2 - PRODUCTS

### 2.1 BINDERS

- A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
  1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
  2. Minimum ring size: 1"; Maximum ring size: 3".
  3. When multiple binders are used, correlate the data into related groupings.
  4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

## PART 3 - EXECUTION

### 3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals Submitted in Hard Copy Format:
  1. Prepare data in form of an instructional manual for use by Owner's personnel.
  2. Format:
    - a. Size: 8-1/2" x 11"
    - b. Text: Manufacturer's printed data or neatly typewritten.
  3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable
    - c. Identity of general subject matter covered in the manual.
  6. Binder as specified
- B. Content of Manual:
  1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement
    - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
  2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information.

## OPERATION AND MAINTENANCE (O&M) MANUALS OF COMMUNICATIONS SYSTEMS

3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  4. Written text as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  5. Copy of each warranty, bond and service contract issued
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts:
      - 1) Function, normal operating characteristics, and limiting conditions.
      - 2) Performance curves, engineering data and tests.
      - 3) Complete nomenclature and commercial number of replaceable parts.
    - b. Operating procedures:
      - 1) Start up, break-in, routine / normal operating instructions
      - 2) Regulation, control, stopping, shut down and emergency instructions
      - 3) Special operating instructions
    - c. Maintenance procedures:
      - 1) Routine operations
      - 2) Guide to trouble-shooting
      - 3) Disassembly, repair and reassembly
      - 4) Alignment, adjusting and checking
      - 5) Routine service based on operating hours
    - d. Manufacturer's printed operating and maintenance instructions.
    - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - f. Complete equipment field accessible wiring diagrams
    - g. Each Contractor's coordination drawings
    - h. Other data as required under pertinent sections of the specifications
  2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
  4. Provide complete information for products specified in Division 27.
  5. Provide certificates of compliance as specified in each related section.
  6. Provide start up reports as specified in each related section.
  7. Provide signed receipts for spare parts and material.
  8. Provide training report and certificates.

END OF SECTION



SECTION 27 05 00

COMMUNICATIONS BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.
- B. Applicable provisions of this section apply to all sections of Division 27, Communications.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
  - 1. Division 26 in its entirety.
  - 2. Division 27 in its entirety.
  - 3. Division 28 in its entirety.
- D. The entire drawing and specification package apply to the work specified in the communication specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with current and applicable Codes, Standards, Rules, Ordinances, Regulations, and Best Practices (both published and best practices) as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities (including those not specifically listed in this Specification). Applicable Codes and Standards shall consist of, but not be limited to the following:
  - 1. Americans with Disabilities Act (ADA)
  - 2. Authorities Having Jurisdiction (AHJ) - Local
  - 3. American National Standards Institute (ANSI)
  - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
  - 5. Building Industry Consulting Services International (BICSI)
  - 6. Code of Federal Regulations - Title 47
  - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
  - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
  - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
  - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
  - 11. International Electro-technical Commission (IEC)
  - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
  - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
  - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
  - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
  - 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
  - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
  - 18. National Electrical Safety Code (NESC)

COMMUNICATIONS BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
  20. Society of Cable Telecommunications Engineers (SCTE)
  21. Local Accessibility Standards
  22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
  23. Uniform Building Code (UBC)
  24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*
- B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- D. Obtain all permits required.

### 1.3 SUMMARY

- A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.
- B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.
- C. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans, and specifications are to be returned to the Architect following completion of bid.

### 1.4 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
  2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
  3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
    - a. Licenses, as applicable to the system being installed
    - b. Manufacturer's Certifications
      - 1) Firm Certification
      - 2) Installer Certification
      - 3) Programmer's Certification
      - 4) System Designer Certification.

### 1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.

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- C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.
- D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.
- E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.
- H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.
- I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.
- J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

#### 1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically

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noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

- C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.
- D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.
- E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.7 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3" beyond the finished surface. In pipe chases, they shall extend 8" inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio. 1/2 inch greater than outside diameter of the conduit.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
  - 1. Make final connections to all communications equipment indicated on the drawings, except as noted.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

#### 1.8 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

#### 1.9 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

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1.10 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 27 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.
- B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.
- C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
1. Obtained from utility maps and other substantially reliable sources.
  2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser

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dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television (A.K.A. Main Antenna Television)
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nanometer
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet (Now referred to as TR)
T.O.	Telecommunications Outlet
TR	Telecommunications Room (A.K.A. TC - Telecommunication Closet)
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

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Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to workstations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

## 1.16 QUALITY ASSURANCE

### A. Equipment Standards:

1. System and all components shall be brand new stock from manufacturer.

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2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

B. Contractor Qualifications:

At the time of Proposal, the Contractor shall:

1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

A. Provide SUBMITTALS according to Division 01 and the following.

B. Requirements:

1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal component in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact

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locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under-slab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 or later / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
  - 1. 3 sets of electronic AutoCAD (2014 dwg or later) / Revit CAD drawing files, on CD-

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- ROM media, of each contract as-built drawing.
- 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
- 3. Three sets of blue or black-line prints of each contract as-built drawing.

- C. As-Built Drawings should indicate the following information as a minimum:
- 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's Seal, name, address, and logo from drawings.
  - 3. Mark documents AS-BUILT DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY:
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
  - 6. Indicate exact location of all underground communications raceways, and elevations.
  - 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
  - 10. Exact location of all communications equipment in and outside of the building.
  - 11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
  - 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 13. Cloud all changes.

#### 1.26 OPERATING TESTS

- A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

#### 1.27 WARRANTY

- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.
- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

#### 1.28 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

#### 1.29 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.

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- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.30 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

- A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.4 MANUFACTURE'S INSTRUCTIONS

- A. The Contractor is responsible for furnishing the proper Communication equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

2.5 RUST PREVENTION

- A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.6 STORAGE AT SITE

- A. The Contractor shall not receive material or equipment at the job site until ready for installation

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or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

- B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.
- C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

## 2.7 CONDITION OF MATERIALS

- A. All materials required for the installation of the Communication systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

## 2.8 NAMEPLATES

- A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

## 2.9 ACCESS DOORS

- A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
  - 1. Plaster Surfaces: Milcor Style K.
  - 2. Ceramic Tile Surfaces: Milcor Style M.
  - 3. Drywall Surfaces: Milcor Style DW.
  - 4. Install panels only in locations approved by the Architect.

## 2.10 SPACE LIMITATIONS

- A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.
- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals

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and As-Built drawings.

- E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. Ground busses shall be provided in each any room with communication equipment.
- J. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.
- K. Communications grounding system shall be a single point grounding from the building entrance electrical ground to each Communications room.
- L. All Conduit systems, cabinets' racks, cable trays, protector blocks, SCTP patch panels and/or miscellaneous equipment, etc. shall be grounded by being connected to the common communications grounding system. The conductors shall be a # 6awg solid with a green jacket
- M. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.
- N. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.
- O. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.
- P. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- Q. The installation shall be performed in a professional manner.
- R. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.
- S. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- T. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.
- U. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

### 3.2 COORDINATION WITH OWNER / ARCHITECT

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- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

### 3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

### 3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

### 3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady

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Type B-32 *or equal*). Handwritten tags are not acceptable.

- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.
- C. All panels shall be provided with permanently attached engraved lamaroid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. Identification of Equipment:
  - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
  - 2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and communications (voice, data, video) cabinet or rack.
    - a. Identifying nameplates shall have 1/2-inch high, engraved letters. For equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "IDF(FCR) XXYY –served from MDF (BCR) XXGG).
  - 3. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.
  - 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
  - 5. Communication hardware located above accessible ceilings: Provide 1/2-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. "A/V-EQ".
- E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

### 3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

### 3.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate,

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listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

- B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
  - 1. Provide the training during regular working day.
  - 2. The Instructors shall be experienced in their phase of operation and maintenance of the systems and with the project.
- C. Time to be allocated for instructions.

The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include training as specified per system specification,

  - 1. Minimum of four (4) hours dedicated instructor time
  - 2. 2-hour sessions on different, non-consecutive days
  - 3. Additional instruction time for specific systems as specified in other Sections.
- D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
  - 1. One copy to the Owner
  - 2. One copy to the Architect / Engineer
- E. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.
- F. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- G. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.
- H. Demonstrate equipment functions (both individually and as part of the total integrated system).
- I. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- J. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- K. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- L. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.8 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

### 3.9 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's

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- representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.10 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

### 3.11 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

### 3.12 EQUIPMENT BACKBOARDS

- A. Backboards:  $\frac{3}{4}$  inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
  2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each communications location.

### 3.13 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

### 3.14 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.
- B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.
- C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the

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items to good operative order. All relocations shall be performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.

- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

### 3.15 EXISTING SYSTEM TESTING

- A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 27 umbrellas, as identified in the Division 27 of the Construction Specifications Institute (CSI) current Master Format . Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.
- B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.
- C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.
- D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

### 3.16 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.
- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
  - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
  - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

### 3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

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- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.
- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

### 3.18 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
  - 1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
  - 2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
  - 3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
- C. Testing:
  - 1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
  - 2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
  - 3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
  - 1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
  - 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
  - 1. System Operations and Maintenance Manuals
  - 2. System Test Reports
  - 3. As-Built Drawings

### 3.19 FINAL ACCEPTANCE

- A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements
- B. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect

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completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 27 05 07

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 01 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- D. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
  - 1. Actual technology equipment and components to be furnished.
  - 2. NEC working space and NEC access to NEC working space.
  - 3. Relationship to other equipment and components and openings, doors and obstructions
  - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
  - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
  - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA



casework, cabinetwork and built-in furniture.

#### 1.4 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
  - 2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and telephone number
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
  - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items requiring correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a resubmittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the

submittal with requirements of the work and of Contract Documents.

- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
  - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 1.

### PART 2 - PRODUCTS - NOT USED

### PART 3 - EXECUTION

#### 3.1 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit individually bound shop drawings and product data for the following when specified or provided:
  - 1. Structural Cabling
  - 2. Communications System
  - 3. Sound Reinforcement System
  - 4. CATV System

#### 3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION



SECTION 27 05 09

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

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

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 MOCK UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

CONTRACT QUALITY CONTROL

- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

#### 1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
  - 1. Rough-in
  - 2. Finish with all appurtenances in place
  - 3. Demonstrations

### PART 2 - PRODUCTS

#### 2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

### PART 3 - EXECUTION

#### 3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

#### 3.2 MOCK-UPS

- A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 27 05 10

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smoke stop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson.
- B. 3M (Minnesota Mining Manufacturing).
- C. Hilti
- D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION





SECTION 27 10 00

STRUCTURED CABLING SYSTEM (SCS)

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

- A. Conditions of the Contract
- B. Division 1
- C. Division 26
- D. Division 27
- E. Division 28

1.2 DESCRIPTION

A. Summary of Work:

1. This work is owner furnished, owner installed.
2. Reference Attachment 'A' of this specification for supplemental scope as it relates to the project and the Owner standards.
3. Provide a complete and tested Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay cabinets/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/EIA/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
4. An IDF will be required when the distance between outlet terminations and MDF/IDF exceeds 280', including service loops. IDF's shall be selected and organized to be minimum in number while still reaching all locations to be wired.
5. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.
6. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Acceptable manufacturers:

1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required. The contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the project.
2. The approved manufacturers shall provide a complete End-to-End solution with the maximum product and performance warranty offered by the specified manufacturer.
3. Only products listed in Attachment 'B' or approved in compliance with the project manual's approval requirements will be accepted.

STRUCTURED CABLING SYSTEM (SCS)

- B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Structure Cabling System installations.
  2. The SCS Installer shall be a Certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
  3. The installing contractor must have a full-time employed RCDD (Registered Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.
  4. All individuals installing the SCS must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
  5. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.
- C. Low Voltage Meeting Requirements:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.
  2. The successful contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other contractors.
  3. Prior to the installation of any items required for this scope of work the contractor must provide a purchase order with a detailed material list for all materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.
- D. Acceptance: The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E. Warranty:
1. The selected system installer shall be a certified installing contractor of product and hold current certification. Contractor shall provide the specified manufacturer's maximum end-to-end performance warranty on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL cable links have been tested bi-directionally (end to end) using a Level IIIe or better tester, per TSB-67, and that all test results conform to the most current ANSI/TIA-568.2-D.
  2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
  3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ANSI/TIA/EIA-568.3-D. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

#### 1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
  2. National Electrical Code, current version
- B. Other References:
1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
  2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1:

- General Requirements.
3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
  4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
  5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
  6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
  7. ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
  8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
  9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
  10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
  11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
  12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
  13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
  14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
  15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
  16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure
  17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
  18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
  19. TIA/EIA 942 Data Center Standards
  20. Current BICSI Telecommunications Distribution Methods Manual
  21. NFPA 70 – National Electrical Code (NEC).
  22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).

- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

## 1.5 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- |      |                                                 |
|------|-------------------------------------------------|
| IDF  | Intermediate Distribution Frame                 |
| MDF  | Main Distribution Frame                         |
| UTP  | Unshielded Twisted Pair                         |
| SCS  | Structured Cabling System                       |
| RCDD | Registered Communications Distribution Designer |

## 1.6 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
  2. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated

3. what specific product is to be provided  
Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
  4. Testing: Proposed Contractor UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.
  5. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
  6. Each Submittal must have a detailed parts list with quantities.
  7. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
    - a. BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the project.
    - b. Certifications must be obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
    - c. Certifications must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
    - d. Fiber Optic Technician Certification: This certification must be held by the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and testing.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current. Identifiable, separate routing shall be shown for both the station cabling and the MDF-to-IDF tie cabling.
  2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
    - a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
    - b. Location of sleeved wall pass-thru
    - c. Size of sleeve at each location installed
    - d. Quantity of cable passing through each sleeve
    - e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
    - f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
  3. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
  4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.
- C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.
- D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:

1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
7. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
8. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
9. A copy of the manufacturer's warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.
13. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation with final graphic numbering. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Reference Attachment 'B' to this specification, which contains the minimum materials list for this specific project.
- B. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- C. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.
- D. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.

## STRUCTURED CABLING SYSTEM (SCS)

- E. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
- |     |                                   |
|-----|-----------------------------------|
| CM  | Communications Cable              |
| CMP | Plenum Rated Communications Cable |
| CMR | Riser-Rated Communications Cable  |
- F. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- G. Cable Lubricants:
1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
  2. Approved Products
    - a. Twisted-pair cable: Dyna-Blue
    - b. American Polywater
- H. Fire Wall Sealant:
1. Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
  2. Approved Products
    - a. 3M or
    - b. Pre-approved equal

## 2.2 DATA CLOSET (MDF/IDF) HARDWARE

- A. Equipment Cabinets/Cabinets: Provide and install equipment cabinets and/or cabinets in locations indicated on the attached drawings for the following areas.
1. For all MDF/IDF locations: Contractor shall provide and install a new floor mounted cabinet/rack system or a wall mounted cabinet where indicated on plans. Refer to floor plan and enlarged MDF/IDF room layouts for number of cabinets/racks to provide at each location. If an enlarged detail is not available, the contractor shall provide the required number of racks to accommodate 100% of all termination components and an equal amount of owner equipment; as well as (1) spare rack. If an MDF/IDF is located in shared space, the contractor shall provide a floor supported, wall mounted cabinet system with all required doors and side panels to secure the equipment and termination components.
- B. Distribution Cabinet/Cabinet Grounding: All Cabinets and/or Cabinets shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.
- C. Fiber Optic Patch Panels:
1. The enclosures used shall provide termination panels for the specified type of connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19" cabinet mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.
  2. Provide closet connector housing panels, size for 110% of total fiber count to be terminated.
  3. ALL fiber strands must be terminated in fiber housing.
- D. Patch Panels:
1. All patch cables shall be modular type patch panels to allow individual jacks to be inserted. All patch panels shall be fully populated with Jacks. Provide dust caps for all unused jacks. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.
  2. Provide cable support bars at the back of all patch panels to provide additional support at rear of panels. Provide one (1) support bar for each row of 24-ports. Support bars will not

be required if the closet design consist of rear horizontal cable management above and below each patch panel.

- E. Rack Electrical:
  - 1. A power strip shall be installed vertical at the back of each data relay rack.
  - 2. Project electrical contractor to provide and install one electrical receptacle for each UPS installed on the entire project. Coordinate receptacle type and location with the installed product requirements and the technology consultant prior to installation.
- F. Cable Management Panels:
  - 1. Provide cable management panels as required for vertical cable management on ends and in between all racks on entire project.
  - 2. Provide Velcro straps for cable dressing in MDF/IDF rooms.
- G. MDF/IDF Patch Cables:
  - 1. Cabling Contractor shall provide owner with one (1) patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
  - 2. All patch cables shall be factory terminated. NO EXCEPTIONS.

## 2.3 CABLE ROUTING/PATHWAY

- A. Cable Tray:
  - 1. Metal cable tray shall be provided to affix to the top of all floor mount cabinets. Cable tray shall be used to brace cabinets to walls and to route cable from walls to cabinets in communication closets.
  - 2. Contractor to provide and install all applicable installation accessories.
- B. Cable Support System:
  - 1. All low voltage cabling shall be installed and supported using an approved cable support system installed at 48" intervals unless installed in conduit. Do not exceed manufacturer's recommendation for the quantity of cables supported in an individual support.
  - 2. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
  - 3. Cable supports shall not exceed a serviceable height of more than 5', but no closer than 2', above the finished ceiling.
  - 4. Cable supports can be attached to vertical walls or the building's structure.
  - 5. If attached to the building's structure, 3/8" threaded rod shall be utilized to extend down within the serviceable heights mentioned above. Grid wire hangers will not be accepted.
- C. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.
- D. Conduit Bushings shall be installed prior to the installation of any cable. If cable is found to be installed without the bushing the cable will have to be removed and re-installed. No cut bushings will be accepted. If cable damage occurs during any portion of the installation, the cable will be removed and replaced at no cost to the project. This item will be strictly enforced and adhered too.
- E. The projects electrical contractor shall provide and install all metallic conduit and backboxes indicated to be installed on the drawings. It is the SCS installer's responsibility to coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. If box locations and conduit sizes are found to vary from the project documents after installation the SCS installer will bare all financial responsibility to ensure these items are installed correctly. The RCDD for the SCS will be responsible for ensuring conduit sizes are sufficient for cable count while maintaining a 40% fill ratio. If there is not electrical contractor on the project, the SCS Installer shall bear responsibility for the provision and installation of all required raceways.

## 2.4 STATION WIRING

- A Wire: The data and voice wire provided for all outlets shall be four-pair, solid copper conductor,



meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.

- B. Testing: The four-pair UTP cable must be UL Performance Level tested. Each 1000-foot spool must be individually tested with test results affixed to the spool. All cable must be provided on new 1000-foot spools. No shorts will be allowed.
- C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non-plenum rated otherwise.
- D. All cable shall be routed to the center of the room in which it is serving and then route to the outlet location that it is intended for. Provide a 5' service loop in the center of the room and 5' service loop at each workstation outlet properly supported above ceiling. All workstation service loops shall be made in figure eight configurations, no exceptions.
- E. Provide minimum of 10' service loop at all headend locations properly supported above ceiling.
- F. Provide indoor/outdoor, plenum rated category cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

## 2.5 STATION HARDWARE

- A. Information Outlet / Jack Modules:
  - 1. Shall be high quality 8p/8c modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware
  - 2. Shall be standard 8-position, RJ-45 Style, FCC compliant
  - 3. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
  - 4. Shall terminate 26-22 AWG solid or stranded conductors
  - 5. Shall accept FCC compliant 6 position plugs.
  - 6. Shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
  - 8. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
  - 9. Shall be UL Listed and CSA certified.
  - 10. Each jack shall have category rating identified on the front face.
- B. Faceplates:
  - 1. Standard faceplates shall be a minimum of 4-port.
  - 2. Wall mounted telephone faceplates shall be 1-port.
  - 3. All faceplates shall be single gang.
  - 4. All blank inserts color shall be coordinated prior to procurement.
- C. Outlet Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
  - 1. Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
  - 2. Patch cords shall be stranded copper, matching the category of the installed cable.
  - 3. All patch cables shall be factory terminated. No exceptions

## 2.6 FIBER OPTIC PRODUCTS

- A. Multimode: 50/125um, OM4+, multimode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.
- B. Singlemode: Single mode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.
- C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.
- E. Conduit fill shall not exceed 40%.
- F. Damage:
  - 1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
  - 2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.
- H. Conduit and Back Boxes:
  - 1. The Contractor shall ensure that the appropriate back boxes and conduits, for the project, are provided as required.
  - 2. One (1) 1" conduit will be required each outlet that serves one to a maximum six (6) category 6 or a maximum of four (4) category 6A cables. Provide additional conduit for cable counts that exceed this number.
  - 3. One (1) double gang deep box will be required for each technology outlet. All boxes except Presentation outlets will be required to have a single gang reducer ring.

#### 3.2 EQUIPMENT CABINET CONFIGURATION

- A. Equipment Cabinets: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.
- B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel. Vertical cable management panels shall be installed on each side of the cabinet.
- C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure

### STRUCTURED CABLING SYSTEM (SCS)

that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

- E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels. Cable bundles shall not exceed more than 48 cables to patch panel.
- F. Hardware: Provide cabinet and jack panel hardware as required for all data station wiring.

### 3.3 STATION WIRING INSTALLATION

- A. General:
  - 1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
  - 2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
  - 3. All cable shall be routed to the center of the room in which it serves before routing to the outlet location and a 5' service loop shall be provide. An addition 5' service loop shall be provided above ceiling at the outlet location. All service loops shall be figure 8 loops.
- B. Exposed Cable:
  - 1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
  - 2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
  - 3. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes:
  - 1. All cabling placed in ceiling areas must be in conduit, or Panduit Corp. J-MOD modular cable support with Velcro cable wrap at each location. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed. No support shall have more than 48 cables.
  - 2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
  - 3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS.
  - 4. All (48) cable bundles shall be routed directly to the MDF or IDF that serves the area. All bundles shall remain separated for the length of the cable run.
    - a. Provide data outlet for irrigation controllers. Coordinate location with landscape consultant.

- b. Provide data outlet for time clock appliance in main custodian office.
- c. Provide OSP or flooded/gel filled cat6 cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

### 3.4 STATION HARDWARE

- A. Flush Mount Jacks shall be mounted in a faceplate with back box.
- B. Placement:
  - 1. Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.
  - 2. Outlets shall be installed within 3'-0" of power outlets
- C. RJ-45 Jack Pin Assignments:
  - 1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
  - 2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring)

### 3.5 CABLE TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures:
  - 1. Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
  - 2. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "\*" PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".
- E. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.
- F. Twisted Pair Cable Testing:
  - 1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Products shall be tested for compliance with ANSI/TIA/EIA 568A and ISO/IES 11801. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
  - 2. Each wire/pair shall be tested at both ends for the following:
    - a. Wire map (pin to pin connectivity)
    - b. Length (in feet)
    - c. Attenuation
    - d. Near end cross talk (NEXT)
    - e. Power Sum
  - 3. Test equipment shall provide an electronic and printed record of these tests.
  - 4. Test results for each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.

G. Fiber Optic Cable Testing:

1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test to and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
3. After installation the Contractor shall test each fiber strand in accordance the EIA 455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for single mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
5. Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.
6. Multimode: 50/125um micron multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

3.6 INSPECTION

- A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.
1. Written Test Report:
    - a. Complete test results, including actual values associated with tests.
    - b. Show all certifications for telecommunications wiring systems.
    - c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCAD format. Provide electronic copy of drawings to owner in AutoCAD version 2012 or greater.
    - d. Documentation of outlet, cable and cabinet labeling system.
- B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed, and test results certify system to all specified standards.

ATTACHMENT 'A'

PROJECT SPECIFIC SCOPE OF WORK AND INSTRUCTIONS

PART 1 – SUMMARY OF WORK

1.1 DESCRIPTION OF WORK

- A. This project consists of the provision and installation of a Structured Cabling System (SCS) as required to support network connectivity to workstations, telephones, video surveillance, access control, building automation, electrical lighting, and any other system requiring network connectivity. This project is a new, \_\_\_\_\_ Square Foot, \_\_\_\_\_ for \_\_\_\_\_. The project site will be located at \_\_\_\_\_ Rd., City of \_\_\_\_\_, State, ZIP Code.
- B. The work includes provision and installation of a complete Cabling System (SCS) in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both pre-proposal and during the project.
- C. The SCS Installer shall comply with all conditions of the contract and "Division 1 –General Requirements" as they apply to the SCS Scope of Work. It shall be the responsibility of the SCS Contractor to make themselves familiar with all documents.
- D. It should not be assumed that any portions of a complete and functional system are to be *furnished and/or provided by anyone, other than the SCS installer, unless specifically stated otherwise*.
- E. Division of responsibilities:  
OFOI = OWNER FURNISHED AND OWNER INSTALLED  
CFCI = CONTRACTOR FURNISHED AND CONTRACTOR INSTALLED
  - 1. CATEGORY 6A CABLING – OFOI
  - 2. MDF/IDF NETWORK EQUIPMENT – OFOI
  - 3. VOIP TELEPHONES – OFOI
  - 4. WIRELESS ACCESS POINTS – OFOI
  - 5. UNINTERRUPTIBLE POWER SUPPLIES – OFOI
  - 6. RACEWAY: CONDUIT, BACK BOXES, SLEEVES, ETC – CFCI

1.2 STRUCTURED CABLING SYSTEM – ADDITIONAL INSTRUCTIONS

- A. Base Proposal:
  - 1. The SCS Installer shall provide and install a Commscope/Systimax End-to-End Structured Cabling System as per these specifications and associated drawings. The Base bid SCS shall consist of:
    - a. Category 6A cable and connectivity to each Video Surveillance Camera, Voice/Data Outlet, Access Controlled Door, and any other locations requiring Local Area Network Connectivity.
    - b. Category 6A cable and connectivity to each Wireless Access Points.
    - c. Each connectivity solution be a complete Channel Solution; consisting of jacks, patch panel, and patch cables.
    - d. Each channel solution shall be color coded to the system in which it serves.
  - 2. The products specified in Attachment 'B' are intended to establish quality, functionality, color, and standards. The following shall be considered preapproved equivalent for each specific portion of the SCS.
    - a. Category 6A copper cable
      - 1) Commscope/Systimax
    - b. Category 6A copper cabling, termination components, and patch cables
      - 1) Commscope/Systimax
    - c. Fiber Optic Cabling and Components:
      - 1) Commscope
    - d. Metals (racks, cable managers, and cable tray):
      - 1) Commscope
    - e. Manufacturer approval request must be submitted in compliance with the Division

1 instructions and must be received no less than ten (10) business days prior to the posted proposal submission date. No substitutions will be allowed if not submitted per these instructions and approved via official pre-bid addendum.

### 1.3 COPPER PATCH PANELS

- A. The SCS Installer shall provide and install patch panels as per the instructions below.
  - 1. 24-port patch panels shall only be used for copper tie cables and demarcation extensions.
  - 2. Provide dedicated, 48-port patch panels for each of the following system (reference color code chart for designated insert and patch panel color coding per system):
    - a. LAN and IP Telephones
    - b. Wireless Access Points
    - c. IP Intercom
    - d. Video Surveillance Cameras

### 1.4 COPPER AND FIBER OPTIC PATCH CABLE LENGTHS

- A. The SCS Installer shall provide copper and fiber optic patch cables as per the instructions below. All patch cables shall be factory terminated and warranted for the copper and fiber solutions specified.
  - 1. MDF/IDF Copper Patch Cables:
    - a. Patch cables shall be category 6A
    - b. Provide one patch cable for each port on the entire project
    - c. Patch cables to be installed by network equipment installer/programmer
    - d. Patch cable lengths
      - 1) 95% shall be 5'
      - 2) 5% shall be 7'
  - 2. Work Area Outlet Copper Patch Cables:
    - a. Patch cables shall be category 6A
    - b. Provide one patch cable for each port on the entire project
    - c. Patch cables to be installed by the owner.
    - d. Patch cable lengths
      - 1) 90% shall be 10'
      - 2) 10% shall be 15'
  - 3. Wireless Access Point Copper Patch Cables:
    - a. Patch cables shall be category 6A
    - b. Provide one patch cable for each port on the entire project
    - c. Patch cables to be installed by wireless system installer.
    - d. Patch cable lengths
      - 1) Interior Ceiling Access Points: 100% shall be 1.5'
      - 2) Interior Wall Mounted Access Points: 100% 1'
      - 3) Exterior Access Points: 100% shall be 15'
  - 4. Video Surveillance Camera Copper Patch Cables:
    - a. Patch cables shall be category 6A
    - b. Provide one patch cable for each port on the entire project
    - c. Patch cables to be installed by the Video Surveillance System Installer.
    - d. Patch cable lengths
      - 1) Interior Ceiling Cameras: 100% shall be 1.5'
      - 2) Interior Wall Mounted Cameras: 100% 3'
      - 3) Exterior Cameras: 100% shall be 15'
  - 5. IP Intercom Copper Patch Cables:
    - a. Patch cables shall be category 6A
    - b. Provide one patch cable for each IP Intercom device on the entire project, plus an additional twenty (20) for future use.
    - c. Patch cables to be installed by the IP Intercom System Installer.
    - d. Patch cable lengths
      - 1) Interior Ceiling Speakers: 100% shall be 1.5'

- 2) Interior Wall Mounted Speakers: 100% 1'
- 3) Exterior Speakers: 100% shall be 15'
6. MDF/IDF Fiber Optic Patch Cables:
  - a. Patch cables shall be OS2 (Single-mode).
  - b. Patch cable shall be duplex, LC to LC
  - c. Provide quantity sufficient for connecting all network equipment plus 20% for growth.
  - d. Patch cables to be installed by network equipment installer/programmer
  - e. Patch cable lengths
    - 1) 100% shall be 3 meters
7. Prior to submittal and procurement of fiber optic and copper patch cables, the contractor shall coordinate with the project Consultant and Owner of final requirement for cable lengths on the specific project.

#### 1.5 SYSTEM SPECIFIC COLOR REQUIREMENTS

- A. The following information shall apply to the complete SCS Channel. All cable, patch cables, outlet terminations, and closet terminations shall be provided in the colors designated below:

Item	Description	Horizontal Cable	Insert	Patch Cables
1	Data	Blue	Blue	Blue
2	VoIP Telephone	Blue	Blue	Blue
3	Wireless	Orange	Orange	Orange
4	Camera	Lilac	Lilac	Lilac
5	Access Control	Lilac	Lilac	Lilac
6	Intrusion Detection	Lilac	Lilac	Lilac
7	PA System	White	White	White

#### 1.6 DOCUMENTATION

- A. Labels:  
The Contractor will label all outlets using permanent / legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.
1. The following nomenclature shall be used when labeling data/voice jacks:
    - a. All cables being served by MDF closet shall begin with 'A' all IDF served cables shall begin with numerical digit 'B' thru 'Z' designating the specific IDF's identification.
    - b. Next identification character shall be a numeric digit identifying the specific patch panel that is serving outlet (1, 2, 3...)
    - c. Next identification shall note what # data port on patch panel (01 thru 48).
- Example:  
Label of an outlet from 23rd port of the third patch panel from top of rack located at IDF-2 shall read: C-3-23  
Label of an outlet from the 5th port of the second patch panel from the top of rack located in the MDF shall read: A-2-05
- B. Floor Plan:  
A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.
- C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.
- D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.

#### STRUCTURED CABLING SYSTEM (SCS)



- E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.
- F. Access Points: Label ceiling grid with digital label according to location installed and a bright orange  $\frac{3}{4}$ " round dot sticker.

ATTACHMENT 'B'  
MANUFACTURER AND MATERIAL LIST

The Communications Contractor shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Technology Consultant.

MATERIAL LIST

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope	4-post Equipment Rack (45U) 12-24 Tapped Rails, Black	760082560   RK4P45-36A	Provide as shown on Drawing, minimum of one (1) in the Building's MDF.
Commscope	2-post Equipment Rack (45U) 12-24 Tapped Rails, Black	760082479   RK3-45A	Provide as shown on Drawing, minimum of one (1) in the Building's MDF and each IDF.
Chatsworth	12U-21U wall mount cabinet	11996-7**	CUBE-iT wall-mount cabinet. Replace ** with 24 for tempered glad door for Press box application. Replace ** with 36 for IDF application.
Commscope	Vertical Cable Management Kit, 8in W X 84in H Single Sided, Black	760244816	Provide and install between each rack and at both ends of all rack systems
Commscope / Systimax	GigaSPEED X10D® XL® M4800 1U Modular Panel, 48 port, for SYSTIMAX Category 6A and 6 Jacks	760105429   M4800-1U-GS	Provide in quantities as required to terminate 100% of all distribution structured cabling, plus 25% for future growth. Reference project drawings. Voice/Data, Security, and WLAN shall have dedicated panels per system.
Commscope / Systimax	GigaSPEED X10D® XL® M2400 1U Modular Panel, 24 port, for SYSTIMAX Category 6A and 6 Jacks	760118323   M2400-1U-GS	Provide in quantities as required to terminate 100% of all distribution structured cabling, plus 25% for future growth. Reference project drawings. Voice/Data, Security, and WLAN shall have dedicated panels per system.
Commscope	Copper Ground Buss Bar, 1/4 in x 4 in x 12 in	UGBKIT-0412	Provide one (1) in each MDF and IDF on the entire project
Commscope / Systimax	High Density 1U modular cassette sliding Panel, accepts (4) G2 modules or MPO panels, providing up to 48 duplex LC ports, or up to 32 MPO ports	760209940   HD-1U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the IDFs, if not shown on drawings
Commscope / Systimax	High Density 2U modular cassette sliding Panel, accepts (8) G2 modules or MPO panels, providing up to 96 duplex LC ports or up to 64 MPO ports	760209957   HD-2U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings
Commscope / Systimax	High Density 4U modular cassette sliding Panel, accepts (16) G2 modules or MPO panels, providing up to 192 duplex LC ports or up to 128 MPO ports	760209965   HD-4U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings

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MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
CommScope	Rear cable management, rack mountable	360-RCM-RM (760104737)	
CommScope	Rear cable manager bar, 19in, 5in deep	NETCONNECT (557548-1)	
Commscope / Systimax	360 Distribution Adapter Pack, Singlemode, 12 LC with internal shutters	760109389   360DP- 12LC-SM	Provide as required to accommodate 110% of all fiber terminated in each MDF/IDF
Commscope / Systimax	360 Distribution Adapter Pack, Singlemode, 24 LC with internal shutters	760115915   360DP- 24LC-SM	Provide as required to accommodate 110% of all fiber terminated in each MDF/IDF
Commscope / Systimax	Category 5e PowerSUM 1100 U/UTP Patch Pane, 24-port	760182907   1100-U- PS-24	Provide in quantities as required to terminate 100% of all copper backbone cable. Reference project drawings.
Commscope / Systimax	GigaSPEED X10D® 360GS10E Solid Cordage Modular Patch Cord	CPCSSX2-0xFyyy	x' to be replaced with alpha or numeric character depicting the color of the patch cable. 'yyy' to be replaced with a numeric value depicting the patch cable length, in feet. Colors shall comply with designated color of the system each cable is provided for. Length to comply as stated in these specifications and coordinated with the Owner's Technology department
Commscope / Systimax	CommScope® Category 6A U/UTP Cord, Plenum , RJ45 to Ceiling connector, 1.5 ft, WHITE	CCA-CAT6A-PLENUM- WHITE-N018	Provide for all above ceiling terminations (IP Intercom Speakers, Wireless Access Points, Video Surveillance Cameras, etc.)
Commscope	10 ft. x 12 in Ladder Rack Straight Section, Black	760085647   CR-SLR- 10L12W	Provide as shown on drawings. Tray shall route to and between all racks, in each MDF/IDF, on the entire project.
Commscope	Ladder Rack, 90° radius, Horizontal E-Bend Section, 12", Black	760085530   CR90FCB-12W	
Commscope	Ladder Rack Inside Curved Section, 12", Black	760085688   CR90ICB- 12W	
Commscope	Ladder Rack Outside Curved Section, 12", Black	760086082   CR90OCB-12W	
Commscope	Rack-to-Runway Mounting Kit, black in color	760084053   CRR2RRMK	Provide one (1) at the top of each rack and/or cabinet on the entire project.

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MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope	Ladder Rack wall angle support kit, 12", black	760084145   CR6-12WR SK	Provide one (1) at each location where the ladder tray system terminates at a wall
Commscope	Ladder Tray Triangle Support Bracket, 12", Black	760084095   CRTWSBK-12W	Provide every 5' of horizontal ladder tray section routing along the communication room walls.
Commscope	Vertical Wall Bracket	760084137   CRVWBK	Provide one kit every 5' of vertical wall ladder rack, minimum of two kits at top and bottom. Contractor to provide vertical wall cable tray section at locations where the service entrance and backbone thru-floor sleeves are located
Commscope	Ladder Rack protective end cap kit (2 caps), black	760084012   CRPECK	Provide one kit at each exposed end of ladder rack
Commscope	Ladder Tray, junction splice kit, black	760084046   CRTJSK	
Commscope	Ladder Rack, butt splice kit, black	760083899   CRBSK	
Commscope	Ladder Tray Radius Drop Kit, 12", Black	760083956   CRDK-12W	Provide one (1) at each location where cable drops to the rack associated rack.
Commscope	Ladder Rack Retaining Post Kit	760083980   CRRP-8H	Provide one (1) set at all ladder rack junctions and horizontal bends to prevent cable from dropping off thru ladder rack system.
Commscope / Systimax	GigaSPEED X10D® 2091B ETL Verified Category 6A U/UTP Cable, 4 pair count, 1000 ft length, WE TOTE® box	2091B ** 4/23 W1000	** to be replaced with numeric character depicting the color of the cable. Colors shall comply with designated color of the system each cable is provided for. **=Blue for voice/data **=Purple for security cameras, door access **=Orange for wireless **=White for intercom
Commscope / Systimax	GigaSPEED X10D® MGS600 Series Information Outlet	MGS600-yyy	yyy' to be replaced with numeric character depicting the color of the Information Outlet (IO). Colors shall comply with designated color of the system each IO is provided for. Yyy=262 for white for intercom Yyy=318 for blue for data yyy=361 for violet for cameras, access control yyy=112 for orange for wireless
Commscope / Systimax	Single Gang, Stainless Steel, M-Series Faceplate	M1*SP	* to be replaced with a numeric character that depicts the port quantity of the faceplate. All faceplates shall be a minimum of 4-ports, with the exception of specialty outlets such as Wall Phones, Wireless Access Points, Video Surveillance Cameras, etc.

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope	TeraSPEED® Plenum Distribution Cable, interlocking aluminum armored with plenum jacket, 12 fiber	760127803   P-012-DZ-8W-FSUYL	
Commscope	48 Fiber, Single Jacket/Single Armor, Gel-Free, Outdoor stranded Loose Tube Cable, Single Mode	760053280   D-012-LA-8W-F12NS	
Commscope	12 Fiber, Riser Rated, Distribution cable, SM	760086371   R-012-LN-8W-F12BK/25D	
Commscope	Field Installable LC Connector, SM-UPC, Blue, for 250/900u	760117895   SFC-LCF-09-8X	1 per pack
Commscope	Field Installable LC Connector, SM-UPC, Blue, for 250/900u	760117895   SFC-LCF-09-8X-25	25 per pack
Commscope	Singlemode LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser	FEWLCLC42-JXM***	*** to be replaced with a numeric value depicting the cable length in meters
Commscope	25-Pair PowerSUM U/UTP 2061F Series Plenum Cables	2010B WH 25/24 R#####	Provide one (1) from the MDF to each IDF on the entire project. ##### to be replaced with numeric characters that depict the cable length
Panduit	LD non-metallic series low voltage, one-piece hinged design, single channel surface raceway includes adhesive backing and is made of impact resistant material with a smooth finish that will not scratch, peel, or corrode. The raceway includes an assortment of bend radius and standard fittings that complement the offering to help route, protect, and conceal low voltage data, voice, and video cabling	Pan-Way LD surface raceway system.	Coordinate with architect and owner on color.
Dynacom	Unwired, 66-Style Termination Block with clear, hinged cover	66M1-50	Provide one (1) for each 25-pair demarcation extension cable
Dynacom	66 wiring block, metal backboard, blue in color	183C*M	* to be replaced with a numeric value depicting the board size. Provide at each demarcation point for the mounting of the 66 wiring blocks. Board size shall consist two (2) mounting brackets per 25-pair cable installed.
Ditek	10GbE, Single Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-MRJPOES	Provide one for each copper network cable associated with an exterior device, up to two (2) cables. Bond to TGBB per manufacturer's instructions

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Ditek	Rack Mount, 10GbE, 12-Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-RM12NETS	Provide one for every four (4) to ten (12) copper network cables associated with an exterior device and originating at the same MDF/IDF. Bond to TGBB per manufacturer's instructions
Ditek	Rack Mount, 10GbE, 24-Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-RM24NETS	Provide one for every Thirteen (13) to Twenty-Four (24) copper network cables associated with an exterior device and originating at the same MDF/IDF. Bond to TGBB per manufacturer's instructions
EXTENDED DISTANCE POWERED FIBER FOR WIRELESS AP AND VIDEO SURVEILLANCE CAMERAS			
CommScope	Power Express Distribution shelf with alarm module	PFP-PX-S1	Power Express Class 2 shelf and starter kit, accommodates up to 4 modules of 8 SELV/Class 2 outputs, 1U
CommScope	Power Express Distribution module.	PFP-PX-8M	
CommScope	Power Express Blank Slot Panel	PFP-PX-SF	Provide one (1) for every empty slot.
CommScope	SPS Rectifier Power Distribution Shelf	PFP-SPS-1	
CommScope	1600W SPS Power Rectifier module	PFP-SPS-1600M	
CommScope	SPS Rectifier Controller Display	PFP-SPS-C1	Provide one per SPS Rectifier Power Distribution Shelf
CommScope	SPS Rectifier Blank Slot Panel	PFP-SPS-SF	Provide one (1) for every empty slot.
CommScope	CS340 Category 6 U/UTP filled Cable, outdoor direct burial, black jacket, 4 pair count, 1000 ft (305 m) length, reel	UN884019904/10   CS340 BLK C6 4/24 U/UTP RL 1KFT	
CommScope	OS2, Outdoor, 4-Strand Fiber	PFC-S04012	
Transition Networks	Gigabit SFP Module	TN-GLC-LH-SM.	Provide one (1) for each POE extender.
CommScope	PoE Extender, 2 Port Universal Mount, Outdoor, 60 Watt, 2-Port	PFU-P-C-0-060-02	
Hoffman	22" X "22" back panel	CP2424	
Hoffman	24"x24"x8" NEMA-4 junction box.	CSD24248	
Hoffman	Padlock Handle	CWHPTO	

END OF SECTION



SECTION 27 41 16

INTEGRATED AUDIO/VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Integrated Audio-Video Systems and Equipment as part of the Work.

1.2 RELATED DOCUMENTS

- A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.
- B. Reference the Project Manual for related specification sections.
- C. Reference the Project Drawings for additional information.

1.3 SECTION INCLUDES

- A. Project instructions for the Contractor and System description details
- B. System product description
- C. Project completion instructions for the Contractor

1.4 RESPONSIBILITY

- A. Responsibilities include, but are not limited to, the following items:
  - 1. Provide materials, equipment, transportation, and labor necessary for a fully working, tested, and calibrated system. Supply accessories and minor equipment items (such as, but not limited to, power strips, adapters, connectors, mounting hardware, etc.) needed for a complete system, even if not specifically mentioned in these Specifications. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification, supply items and quantities according to the intent of the Specification and Drawings, without claim for additional payment.
  - 2. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of their failure to have brought said discrepancies to the attention of the Architect.
  - 3. Execute work in accordance with the National Electrical Code (NEC), the National Electrical Safety Code, the Occupational Safety and Health Act (OSHA), applicable State and Local codes, ordinances, regulations, authority having jurisdiction (AHJ), and manufacturer's recommendations. If a conflict develops between the contract documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform Work.
  - 4. Required licenses, insurance and permits including payment of charges and fees
  - 5. Verification of dimensions and conditions at the job site.
  - 6. Coordinate location and installation of equipment with other building elements.
  - 7. Preparation of submittal information
  - 8. Pick-up of Owner Furnished Equipment (OFE) and incorporation into project if applicable.
  - 9. Development and implementation of control system software code and control panel layouts, which will become the property of the Owner
  - 10. Final tests and adjustments, written report, and documentation
  - 11. Instruction of operating personnel
  - 12. Provision of manuals
  - 13. Maintenance services and warranty.

1.5 REFERENCES



- A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
1. American National Safety Institute (ANSI)
  2. American Society of Testing and Materials (ASTM)
  3. Electronics Industries Association (EIA)
  4. Federal Communications Commission (FCC)
  5. National Electrical Manufacturer's Association (NEMA)
  6. National Electrical Code (NEC)
  7. Underwriters Laboratories (UL)
  8. Occupational Safety and Health Administration (OSHA)
  9. Society of Motion Picture and Television Engineers (SMPTE)
  10. Building Industry Consulting Service International (BICSI)
  11. Davis and Davis, Sound System Engineering (3rd Edition) (SSE), Howard W. Sams, 2006
  12. Giddings, Audio System Design and Installation (ASDI), Howard W. Sams, 2013
  13. AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm (AVIH), 2009

## 1.6 DEFINITIONS

- A. In addition to those Definitions of Division 1, the following list of terms as used in this specification shall be defined as follows:
1. Furnish - To purchase, procure, acquire, and deliver complete with related accessories.
  2. Install – To set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, items, or equipment supplied by Contractor.
  3. Provide – To furnish and install.

## 1.7 DESCRIPTIONS & REQUIREMENTS

- A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the systems.
- B. Black Box
1. Audio Sources
    - a. Provide an assortment of dynamic and cardioid microphones.
    - b. Provide a wireless microphone system.
    - c. Provide a rack mounted multi-media player for music playback.
    - d. Provide wired and wireless media connectivity.
    - e. Provide cabling and equipment accessories.
  2. Mixing System
    - a. Provide a rack mounted digital mixer.
  3. Processing and Amplification
    - a. Provide DSP amplification for room loudspeakers.
  4. Loudspeakers
    - a. Provide loose loudspeakers with pipe-clamps for mounting to the pipe grid.
    - b. Provide cabling connections around the room for loudspeaker connections at the pipe grid and portable equipment rack at the floor.
  5. Equipment Housing
    - a. Provide a wall mounted equipment rack for housing amplifier and other equipment.
    - b. Provide a portable equipment rack for housing mixer and playback equipment.
  6. Production Intercom
    - a. Provide wired connection to existing production intercom system
    - b. Provide wired connections around the room.
    - c. Provide wired beltpacks with headsets.
    - d. Provide cabling and equipment accessories.
  7. Hearing Assist
    - a. Provide a wireless, single channel radio frequency hearing assist system.
    - b. System must operate on approved FCC frequencies.
    - c. Provide enough portable receivers to meet current ADA standards including:
      - 1) Ear speakers
      - 2) Headsets
      - 3) Inductive coil loops
  8. Video Display

- a. A 65in display shall be provided in the Black Box. This display will have a video feed from the existing Auditorium camera. This display will have a button panel adjacent to control the display on/off.
- b. The video feed will be over cable distance limitations so fiber optics will be require to achieve the functionality.

## 1.8 SUBMITTALS

- A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated.
- B. Submittals shall contain sufficient information to describe the Work to be performed. Reviewed shop drawings are to be used for final coordination and construction.
- C. Shop drawings must be original work produced by the Contractor responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim shall be made for delay, undue burden, or additional costs for the effort to produce shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.
- D. Supplementary submittal requirements:
  - 1. Provide the following in one electronic submission for review within thirty days of issuance of Notice to Proceed (NTP) and prior to commencement of Work:
    - a. Complete schedule of submittals.
    - b. Chronological schedule of Work in bar chart form.
    - c. Product Data Sheets:
      - 1) Provide a complete table of contents with the following information:
      - 2) Project title.
      - 3) Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix "R" immediately followed by a unique number and be numbered in consecutive order.
      - 4) Date of submission.
      - 5) Provide a list of and Manufacturer's data sheets on products to be incorporated with the Work. Arrange data sheets in the same order they appear in this specification. Where a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
      - 6) Submit manufacturer's product literature for each type of firestop material to be used. Literature shall include documentation of UL classifications or approved third party testing. Manufacturer's name and number for each part shall be included. Submit drawings of through penetrations, which include the system to be utilized for the firestopping application. Drawing shall indicate construction of wall or floor assembly; size, number and material of penetrating items; firestop system designation; required F-rating, T-rating and remarks.
      - 7) Upon Owners and/or Consultant's request provide (3) three copies of the submittals. Bind submittal in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.
      - 8) Submissions that do not follow the format and configuration described above will be returned without review.
    - d. Shop Drawings:
      - 1) Functional Diagrams/Schematics:
        - a) Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and designators, and device designators for each system. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.
      - 2) Coordination Drawings:
        - a) Prepare and submit a set of coordination drawings showing major elements, components, and devices of the audio and video system in relationship with other building components. Prepare drawings to an accurate scale of 1/8"=1'-0" or larger on suitable sized media.
        - b) Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the Work including but not necessarily limited to the following:

- (1) Equipment housings
    - (2) Ceiling and wall mounted devices
    - (3) Raceways
    - (4) Cabling
  - e. Equipment: Location of equipment within racks, consoles, or on tables, with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
  - f. Patch panel(s): Layouts and designation (labeling) strips, including color schemes.
  - g. Full fabrication details of any custom enclosures and millwork indicating size, material, finish and openings for equipment.
  - h. Structural rigging and mounting details:
    - 1) Loudspeaker rigging, suspension, and mounting detail drawings shall be signed and sealed by a professional engineer licensed to practice in the state in which the project is located. The signed and sealed drawings noted above to include the following:
      - a) Analysis of all components in the load path and attachment method to building structure for suspended loudspeakers.
      - b) Attachment method for mounting brackets at ceilings, walls, or other building features.
      - c) Detail the product manufacturer, part numbers, and load capacity of the hardware fittings and materials selected for suspended or mounted loudspeakers.
      - d) A copy of the design calculations.
      - e) Secondary steel required for attachment to the building structure.
      - f) Custom brackets, mounts, suspension grids or trusses, loudspeaker cabinet frames, or loudspeaker brackets.
      - g) Loudspeaker brackets or mounts provided by the specific loudspeaker manufacturer being installed that do not include traceability data.
    - 2) Risk analysis data as referenced in Part 3.2, F
    - 3) Stamping Engineer post-installation sign-off as described in Part 3.2, F
    - 4) Proof of ETCP certification for on-site rigging crew.
  - i. Projector, loudspeaker, camera mounting details, include hardware types and load capacity.
  - j. Fabricated Plates and Panels
    - 1) Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
  - k. Labeling
    - 1) Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
  - l. Schedules
    - 1) Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.
  - m. Control System Software
    - 1) Provide electronic copies of proposed control system user interfaces within sixty (60) days of issuance of Notice to Proceed (NTP).
  - n. IP Addresses
    - 1) Coordinated with the venue IT Administrator, provide a list of IP addresses, by device, used in the project.
  - o. Consultant's project documents in electronic format will not be supplied to the Contractor for their use as part of submittals.
  - p. Detail drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'-0".
  - q. Submissions that do not follow the format and configuration described above will be returned without review.
  - r. Any other pertinent data which is necessary to provide the Work.
2. Control System Software:
- a. Provide electronic copies of proposed control system user interfaces within sixty (60) days of issuance of Notice to Proceed (NTP).
- E. Resubmission requirements:
- 1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
  - 2. Indicate all changes that have been made other than those requested.

#### 1.9 CONTRACT CLOSE-OUT DOCUMENTS:

- A. Provide submittals in accordance with Conditions of the Contract and Division 1, Submittal Procedures section unless otherwise indicated, after substantial completion but prior to final observation:

B. Supplementary submittal requirements:

1. Provide the following in one electronic submission for review.
  - a. Equipment Manuals:
    - 1) Manufacturer's owner/instruction manual for each type of Product by manufacturer and model or part number unless specified otherwise herein
    - 2) Supply manufacturer's serial numbers for each Product
    - 3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item
    - 4) Separately bind list by manufacturer and model or part number of Products incorporated within the Work, arranged in alpha numeric order. When applicable, bind Manufacturer's warranty statements separately.
  - b. Test Reports: Recorded findings of Commissioning.
  - c. Signed copy of turn over equipment to Owner including quantity, make and model.
  - d. Copy of any program or hardware setup files.
  - e. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
    - 1) This procedure should describe the operation of system capabilities.
    - 2) Assume the intended reader of the manual to be technically inexperienced but unfamiliar with the components and the facility.
  - f. Provide Consultant with copy of Owner training video.
  - g. Service Information, including service phone number(s) and hours; service schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
  - h. Any other pertinent data generated during the Project or required for future service.
  - i. Within three (3) weeks of final observation, submit the following in one electronic submission for review. Upon Owners and/or Consultant's request provide (3) three copies of the following:
    - 1) Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
    - 2) Hardcopy full size set of Record drawings.
    - 3) Three (3) compact disc or DVD's containing Record drawings in AutoCAD editable DWG format and Adobe PDF format. Resolution to be sufficient to permit Owner's technicians to be able to clearly read all notes and text on screen.
    - 4) One set of signed proof-of-training documents.
2. Submittal Format:
  - a. Record Drawings: Drawings executed at an appropriate scale, but not smaller than 1/8 inch = 1'-0".
  - b. Segregate documents into separate binders containing data relevant to operational, maintenance, and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.
  - c. Bind Project Record Manual in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three inch spine. Use multiple volumes as required. Separate major grouping with labeled binder tabs.

C. Resubmission requirements:

1. Make all requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate all changes that have been made other than those requested.

1.10 CUSTOM SOFTWARE

A. Introduction:

1. Proprietary software provided for the Technical Systems shall be subject to this software license between the Contractor and the Owner as an essential element of the system as defined in the system specification and associated documents, drawings and agreement.
2. Contractor shall agree that 3rd party proprietary software provided with the system shall be subject to this agreement.
3. Contractor and Owner agree that this software license is deemed to be part of, and subject to, the terms of the Agreement applicable to both parties; and shall supersede any standard manufacturer or Contractor's standard license agreement.
4. Proprietary software shall be defined to include, but not be limited to, device and system specific software and firmware designed to run on conventional computer based operating platforms as well as all micro-processor based hardware used to program, setup, or operate the system or its components.
5. For sake of this agreement, MS Windows® shall not be considered "proprietary" software, unless a non-public version of Windows® or any of its components are critical to the operation of the system in which case it shall be deemed proprietary.

B. License Grant and Ownership:

1. Contractor hereby grants to Owner a perpetual, non-exclusive, site license to all software for Customer's use in connection with the establishment, use, maintenance and modification of the system implemented by Contractor. Software shall mean executable object code of software programs and the patches, scripts, modifications, enhancements, designs, concepts or other materials that constitute the software programs necessary for the proper function and operation of the system as delivered by the Contractor and accepted by the Owner.
2. Except as expressly set forth in this agreement, Contractor shall at all times own all intellectual property rights in the software. Any and all licenses, product warranties or service contracts provided by third parties in connection with any software, hardware or other software or services provided in the system shall be delivered to Owner for the sole benefit of Owner.
3. Owner may supply to Contractor or allow the Contractor to use certain proprietary information, including service marks, logos, graphics, software, documents and business information and plans that have been authored or pre-owned by Contractor. All such intellectual property shall remain the exclusive property of Owner and shall not be used by Contractor for any purposes other than those associated with delivery of the system.

C. Copies, Modifications, and Use:

1. Source code shall be available to Owner for a period of not less than 10 years.
2. Owner may make copies of the software for archival purposes and as required for modifications to the system. All copies and distribution of the software shall remain within the direct control of Owner and its representatives.
3. Owner may make modifications to the source code version of the software, if and only if the results of all such modifications are applied solely to the system. In no way does this Software License confer any right for Owner to license, sublicense, sell, or otherwise authorize the use of the software, whether in executable form, source code or otherwise, by any third parties.
4. All express or implied warranties relating to the software shall be deemed null and void in case of any modification to the software made by any party other than Contractor.

D. Warranties and Representations:

1. Contractor represents and warrants to Owner that:
  - a. It has all necessary rights and authority to execute and deliver this Software License and perform its obligations hereunder and to grant the rights granted under this Software License to Owner;
  - b. The goods and services provided by contractor under this Software License, including the software and all intellectual property provided hereunder, are original to Contractor or its subcontractors or partners; and
  - c. The software, as delivered as part of the system, will not infringe or otherwise violate the rights of any third party, or violate any applicable law, rule or regulation.
2. Contractor further represents and warrants that, throughout the System Warranty Period, the executable object code of software and the system will perform substantially in accordance with the System Specifications and Agreement. If the software fails to perform as specified and accepted all remedies are pursuant to the policies set forth in the Specification and in the Agreement. No warranty of any type or nature is provided for the source code version of the software which is delivered as is.
3. Except as expressly stated in this Agreement, there are no warranties, express or implied, including, but not limited to, the implied warranties of fitness for a particular purpose, of merchantability, or warranty of no infringement of third party intellectual property rights.

## 1.11 QUALITY ASSURANCE

A. Qualifications: Contractor to be experienced in the provision of systems similar in complexity to those required for this project, and meet the requirements listed below. Provide documentation at the time of bid to support these qualifications:

1. Form of corporation.
2. No less than three years' experience with equipment and systems of the specified types.
3. Experience with at least three comparable scale projects within the last three years.
4. Be a franchised dealer and service facility for the manufacturer's products furnished.
5. Maintain a fully staffed and equipped service facility with full-time field technicians.
6. Have at least one supervisory on-site employee who has completed and has been certified CTS-I by Infocomm.
7. Supervision of all rigging by an ETCP certified rigger for all work associated with suspension or mounting of overhead equipment.
8. Adequate plant capacity and equipment to complete the Work.
9. Adequate staff with commensurate technical experience.

10. Suitable financial status (i.e., bonding and materials purchase capacity) to meet the obligations of the Work.
  11. Adequate regional service organization to meet warranty response requirements of the Project.
  12. Provide listing with appropriate explanation regarding the status of Contractor's resolved or unresolved legal disputes within the last six calendar years.
  13. Provide listing with appropriate explanation regarding any projects within the last 3 years where the Contractor has failed to meet construction schedules due to Contractor's cause.
  14. Completed current version of the AIA Contractor's Qualification Form.
- B. Subcontractors: at the time of bid, the Contractor shall provide a list of structural, electrical, sound, or any other subcontractors intended to do the Work, or are being retained as local service providers throughout the warranty period. Subcontractors shall be appropriately state licensed in their specialty and must provide the same qualification documents as the Contractor.
- C. Work: Perform Work in compliance with the applicable standards listed herein and governing codes and regulations of the authorities having jurisdiction and the Contract Documents.
1. Drawings and specification requirements govern where they exceed Code and Regulation requirements.
  2. Where requirements between governing Codes and Regulations vary, the more restrictive provision applies.
  3. Nothing in the Contract Documents grants authority or permission to disregard or violate any legal requirements.
- D. Coordinate exact location and installation of equipment, power, grounding, and raceway requirements with the Architect.

#### 1.12 DELIVERY, STORAGE & HANDLING

- A. Ship Products in its original container, to prevent damaging or entrance of foreign matter.
- B. Handling and shipping in accordance with Manufacturer's recommendation.
- C. Provide protective covering during construction of all installed devices, to prevent damaging or entrance of foreign matter.
- D. Replace at no expense to Owner, Products damaged during storage, handling or the course of construction.

#### 1.13 PROJECT CONDITIONS

- A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
- B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to Architect for approval, showing how the work may be installed.

#### 1.14 WARRANTY

- A. Warrant labor and equipment for one year following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or equipment within the Warranty period without charge.
- B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.
- C. Within the warranty period, answer service calls within twenty four (24) hours during normal working hours and correct the deficiency within forty eight (48) hours.
- D. Provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Closeout Documents.

- E. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment (OFE). Coordinate observation visit with the Owner.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Products quantity is as required. If a quantity is given, provide at least the given amount. Some product listed may not be required to fulfill the obligations of the Work.
- B. Equipment and materials shall be new and conform to applicable UL or ANSI provisions.
- C. Regardless of the length or completeness of the descriptive paragraph herein, provide Products complying with the specified manufacturer's published specifications.
- D. Remove or blank out all manufacturers' names, logos, or other symbols from loudspeakers or other objects placed in view of the public. If logos are removable, remove and repaint to the color of the adjacent surface and reattach.
- E. Take care during installation to prevent scratches, dents, chips, etc.

### 2.2 ACCEPTABLE MANUFACTURERS

- A. Model numbers and manufacturers included in this specification are listed as a standard of function, performance, and quality.
- B. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure.
- C. If a specified product has been discontinued by a manufacturer, provide the replacement model (as certified by the manufacturer) at no additional cost.
- D. Where required provide manufacturer's rack mount adapter or one manufactured by Middle Atlantic or Winstead unless specified elsewhere.

### 2.3 MICROPHONES AND ACCESSORIES

- A. Single Wireless Microphone System (WRLS, Type 1)
  - 1. Not specified
- B. Dual Wireless Microphone System (WRLS, Type 2):
  - 1. Receiver Type: Digital Wireless System with automatic switching diversity reception with XLR type audio output connectors.
  - 2. Indicators: LED signal strength meters for battery, RF and audio levels.
  - 3. Frequency: Coordinate with FCC and local requirements.
  - 4. Antennas: Rear mount passive antennas for the frequency spectrum chosen.
  - 5. 1-RU Rack mountable.
  - 6. Acceptable Product:
    - a. Shure ULXD4D Diversity Receiver
- C. Triple Wireless Microphone System (WRLS, Type 3)
  - 1. Not specified
- D. Quad Wireless Microphone System (WRLS Type 4):
  - 1. Receiver Type: Digital Wireless System with automatic switching diversity reception with XLR type audio output connectors.
  - 2. Indicators: LED signal strength meters for battery, RF and audio levels.
  - 3. Frequency: Coordinate with FCC and local requirements.
  - 4. Antennas: Rear mount passive antennas for the frequency spectrum chosen.
  - 5. 1-RU Rack mountable.

- 6. Acceptable Product:
  - a. Shure ULXD4Q Diversity Receiver
- E. Bodypack Wireless Microphone (Type 1)
  - 1. Theatrical headset/lapel mic
  - 2. Acceptable Product:
    - a. Shure ULXD1 Bodypack Transmitter
      - 1) Shure SB900B Lithium Ion Battery
      - 2) Shure UL4#-MTQG Headset Microphone (coordinate color with Owner)
      - 3) Shure MX153 Headset Microphone (coordinate color with Owner)
- F. Handheld Wireless Microphone (Type 1)
  - 1. Beta 87A capsule
  - 2. Acceptable Product:
    - a. Shure ULXD2/B87A Handheld Transmitter
      - 1) Shure SB900B Lithium Ion Battery
- G. Wireless Microphone Charge Base (Type 1)
  - 1. 8 Port Wireless Microphone Charging Dock
  - 2. Acceptable Product
    - a. Shure SBC800-US Battery Charger Base
- H. General Purpose Microphone: (Type 1)
  - 1. Handheld dynamic cardioid pattern
  - 2. Acceptable Product:
    - a. Shure SM58
    - b. Approved Equivalent
- I. Microphone Stands and Mounting Hardware:
  - 1. Acceptable Product:
    - a. TYPE 1: Round-base floor stands, Black
      - 1) Atlas MS-10CE w / PB11XEB
      - 2) Approved Equivalent
    - b. TYPE 2: Heavy Duty floor stand, Black
      - 1) Atlas SB11WE
      - 2) Approved Equivalent
    - c. TYPE 3: Boom Arm Short, Black
      - 1) Atlas PB11XEB
      - 2) Approved Equivalent
    - d. TYPE 4: Boom Arm Long, Black
      - 1) AtlasPB21XEB
      - 2) Approved Equivalent
    - e. TYPE 5: Tabletop stand, Black
      - 1) Atlas SMS2B
      - 2) Approved Equivalent

## 2.4 INPUT SOURCES

- A. Media Player (MDP, Type 1):
  - 1. Analog and outputs: RCA unbalanced.
  - 2. 1-U Rack Mountable.
  - 3. Bluetooth Receiver
  - 4. USB & Aux input
  - 5. Wireless Remote Control.
  - 6. Acceptable Product:
    - a. Tascam CD-400U
- B. Stereo DI Box (Type 1):
  - 1. Inputs for stereo/dual mono unbalanced line sources
  - 2. Inputs shall be via ¼", RCA, 3.5mm receptacles
  - 3. Line and mic level outputs
  - 4. Ground lift switch
  - 5. Acceptable Product:
    - a. Whirlwind DIRECT2



- b. Radial ProAV2
  - c. Approved Equivalent
- C. Stereo Computer DI Box (Type 1):
- 1. Inputs for stereo/dual mono unbalanced line sources
  - 2. Inputs shall be via ¼", RCA, 3.5mm receptacles
  - 3. Line and mic level outputs
  - 4. Ground lift switch
  - 5. Acceptable Product:
    - a. Whirlwind PC-DI
      - 1) ProCo BPMBMB-3 3.5mm TRS Cable
    - b. Radial JPC
      - 1) ProCo BPMBMB-3 3.5mm TRS Cable
    - c. Approved Equivalent

## 2.5 MIXERS

- A. Mixer (MIXER, Type 1):
- 1. 16 input digital rackmount mixer
  - 2. 16 outputs
  - 3. 72 channels
  - 4. 48 mix busses
  - 5. Rack Mountable
  - 6. Network digital audio native
  - 7. Acceptable Product:
    - a. Yamaha DM7 Compact
- B. Portable Expander (MIX IO, Type 1)
- 1. Portable digital audio expander.
  - 2. 16 balanced inputs
  - 3. 8 balanced outputs
  - 4. Network digital audio native
  - 5. Acceptable Product:
    - a. Yamaha Rio1608-D2

## 2.6 POWER AMPLIFIERS

- A. General:
- 1. Two, Four, or Eight channel power amplifier with the EIA standard RS-490 power rating at 1% THD into 70-volt constant voltage load or 8-ohm load as applicable.
  - 2. Provide protection of circuit components in the event of input over-drive, output overload, or short circuits.
  - 3. Frequency response:  $\pm 1$  dB, 20 Hz to 20 kHz with less than 1 per cent THD at rated output.
  - 4. Input impedance: 10k ohm balanced.
  - 5. Output regulation: 2 dB from no load to full load conditions.
  - 6. Noise generation: at least 85 dB below rated output with input shorted.
- B. Acceptable products:
- 1. Type 1
    - a. Crown CDi 300 Series
    - b. LEA CONNECT 35x

## 2.7 LOUDSPEAKERS

- A. Speaker (Type 1)
- 1. Type: Surface mounted loudspeaker
  - 2. Configuration: 8-inch two-way loudspeaker
  - 3. Frequency Range: 50 Hz – 25 kHz
  - 4. Power: 400W @ 8 ohms
  - 5. Coverage: 90 x 60-degree
  - 6. Acceptable Product:
    - a. Tannoy VX8
      - 1) Tannoy VXY8 Yoke Mount
      - 2) Mega Clamp MLB

3) Black Safety Cable

- B. Speaker (Type 2)
  - 1. Type: Powered control room monitor
  - 2. Configuration: 5-inch two way
  - 3. Frequency Response: 49 Hz – 43 kHz
  - 4. Power: 75W
  - 5. Acceptable Product:
    - a. JBL 305P Mk II
    - b. Tannoy Reveal 502

2.8 ASSISTIVE LISTENING

- A. ALS Transmitter (ALT, Type 1):
  - 1. Configuration: Single-channel.
  - 2. Frequency: 216 MHz.
  - 3. Audio Input: Balanced, mic or line level, 3-pin XLR.
  - 4. Provide power supply.
  - 5. Provide 1-RU rack mount bracket.
  - 6. Remote mounted antenna (ANT-HA)
  - 7. Acceptable Product:
    - a. Listen Technologies LS-71-216
      - 1) Listen Technologies LA-124 for device/panel mounted antennas
    - b. William Sound FM-558 Pro
      - 1) William Sound ANT 034 for device/panel mounted antennas
- B. ALS Receiver (Type 1):
  - 1. Configuration: Single channel.
  - 2. Frequency: 216 MHz.
  - 3. Frequency agile to adjust various systems.
  - 4. Receivers to be frequency adjustable for use in all venues.
  - 5. Include an individual price for owner to purchase additional receivers.
  - 6. Acceptable Product:
    - a. Listen LR-4200-216 Receiver
      - 1) Listen LA-401 Ear Speaker
      - 2) Listen LA-402 Headset
      - 3) Listen LA-430 Neck Loop
    - b. William Sound FM-R38
      - 1) William Sound EAR 022
      - 2) William Sound HED 024
      - 3) William Sound NKL 001

2.9 PRODUCTION INTERCOM

- A. Belt Unit (Type 1)
  - 1. Two channel station
  - 2. Volume control
  - 3. Mic on/off button
  - 4. Call signal button.
  - 5. Sidetone adjust.
  - 6. Five pin configuration with loop thru.
  - 7. Acceptable Product:
    - a. Clear Com RS-702
      - 1) Clear Com CC-300

2.10 VIDEO DISPLAY EQUIPMENT

- A. 65" LCD Monitor (MON, Type 4):
  - 1. 65" Diagonal
  - 2. Resolution 3,840 x 2,160 (4K UHD)
  - 3. Brightness: 500cd/m2
  - 4. RS232 controllable
  - 5. Interface : HDMI(3)/ DP/ DVI-D/ USB 2.0/ RS232C/ RJ45/ Audio/ IR
  - 6. 10W + 10W Speakers

7. Acceptable Product:
  - a. LG 65UH5J w/Chief RXF3 when wall mounted

## 2.11 VIDEO SWITCHERS

- A. Video Distribution Amplifier / Repeater (SDI-DA, Type 1)
  1. 1x Auto-Sensing Input
  2. 4x Separately Buffered Outputs
  3. Auto Equalization
  4. Universal Power Supply Included
  5. Acceptable Product
    - a. AJA HD5DA
- B. SDI to ST Fiber Mini Converter (FOTX, Type 1)
  1. SDI Input / ST Fiber Output / SDI Loop
  2. Up to 1080p Resolution
  3. Equalized and Reclocked Input
  4. ASI Compatible
  5. Meets All Relevant SMPTE Specifications
  6. Locking Power Connector
  7. 1.5W Power Consumption
  8. Includes 5-20V Worldwide Power Supply
  9. Suitable for Indoor and Outdoor Use
  10. Acceptable Product
    - a. AJA FiDO-T-ST
- C. HD/SD-SDI Over Fiber to HDMI Video and Audio Mini-Converter (FORX, Type 1)
  1. Fiber Optic HD/SD-SDI to HDMI
  2. Supports Single Mode 1310  $\mu$ m Cable
  3. Fiber Optic ST Input Connector
  4. HDMI 1.2 Output
  5. Embedded Audio Support
  6. 2-Channel RCA Audio Output
  7. 3.28' HDMI Cable
  8. Universal Power Supply Included
  9. Acceptable Product
    - a. AJA Hi5-Fiber

## 2.12 CONTROL SYSTEM

- A. Button Panel (BP, Type 1):
  1. Built in controller
  2. Nine buttons customizable with replaceable icon chips, plus power, volume, and mute buttons and a volume gauge
  3. PoE powered
  4. Mounts to 1 or 2 gang electrical box
  5. network, RS-232, IR, relay, and Versiport control ports
  6. Available in black or white
  7. Acceptable Product:
    - a. Crestron MPC3-102B

## 2.13 AV NETWORK HARDWARE

- A. Network Switch (AV SWITCH, Type 1)
  1. Managed
  2. Gigabit switch
  3. PoE+
  4. Streaming compatible
  5. Acceptable Product:
    - a. Netgear M4250 Series
    - b. Packedge SX Series
    - c. Luxul AMS Series
    - d. QSC NS Gen-2 Series
    - e. Approved Equivalent

- B. PoE Injector (POE, Type 1):
  - 1. Single Port LAN PoE
  - 2. 350 mA maximum @ 48 Volts DC nominal
  - 3. PoE Power Sourcing Equipment
  - 4. Acceptable Product:
    - a. Crestron PWE-4803RU

## 2.14 BROADCAST CABLING

- A. Single mode Single Mode Fiber Optic Cable:
  - 1. Single mode gel free fiber optic cable.
  - 2. Single mode fiber to be tight buffered.
  - 3. Cable to be provided with Appropriate NEC rating.
  - 4. Ground armored fiber per code.
- B. Armored 6 Strand Single Mode Fiber:
  - 1. 6 Fiber Riser/Outdoor Rated Product:
    - a. For general use where allowed by Code
    - b. Acceptable Product:
      - 1) Belden FDSD006F9
      - 2) Clark CWF-D006SMRIOA
      - 3) Corning 006E81-31131-A1
      - 4) OCC DZ006DSLX9YRI2
  - 2. 6 Fiber Indoor/Outdoor Plenum Rated Cable:
    - a. For use when cable is exposed to moisture and allowed by code.
    - b. OFCP & Indoor / Outdoor rating. Requires code compliance.
    - c. Water Block Tape.
    - d. Acceptable Product:
      - 1) Belden FDSD006A9
      - 2) Clark CWF-D006SMPIOA
      - 3) Corning 006E8P-31131-A3
      - 4) OCC DZ006TSLX9YPI8
  - 3. Non-Armored 6 Strand Single-Mode Fiber:
    - a. 6 Fiber Plenum Rated Distribution Cable Product:
    - b. For general use where allowed by Code
    - c. Acceptable Product:
      - 1) Belden FDSD006P9
      - 2) Clark CWF-D006SMP
      - 3) Corning 006ZSZ-T3101D2G
  - 4. Armored 12 Strand Single-Mode Fiber:
    - a. 12 Fiber Riser/Outdoor Rated Product:
    - b. For general use where allowed by Code.
    - c. Acceptable Product:
      - 1) Belden FDSD012F9
      - 2) Clark CWF-D012SMRIOA
      - 3) Corning 012E81-31131-A1
      - 4) OCC DZ012DSLX9YRI2
  - 5. 12 Fiber Indoor/Outdoor Plenum Rated Product:
    - a. For use when cable is exposed to moisture and allowed by code
    - b. OFCP & Indoor / Outdoor rating. Requires code compliance
    - c. Water Block Tape
    - d. Acceptable Product:
      - 1) Belden FDSD012A9
      - 2) Clark CWF-D012SMPIOA
      - 3) Corning 012E8P-33131-A3
      - 4) OCC DZ012TSLX9YPI8
  - 6. Non-Armored 12 Strand Single-Mode Fiber:
    - a. 12 Fiber Plenum/Outdoor Rated Distribution Cable Product:
    - b. For general use where allowed by Code
    - c. Acceptable Product:
      - 1) Belden FDSD012P9
      - 2) Commscope 760037192 | P-012-OD-8W-FSUBK
      - 3) Corning 012ZSZ-T3101D2G
  - 7. Armored 24 Strand Single-Mode Fiber.
    - a. 24 Fiber Riser/Outdoor Rated Product.

- b. For general use where allowed by Code
- c. Acceptable Product:
  - 1) Belden F1SD024F9
  - 2) Clark CWF-D024SMRIOA
  - 3) Corning 024E81-33131-A1
  - 4) OCC DZ024DSLX9YRI2
- 8. 24 Fiber Indoor/Outdoor Plenum Rated Product
  - a. For use when cable is exposed to moisture and allowed by code
  - b. OFCP & Indoor / Outdoor rating. Requires code compliance
  - c. Water Block Tape
  - d. Acceptable Product:
    - 1) Belden FDSD024A9
    - 2) Clark CWF-D024SMPIA
    - 3) Corning 024E8P-31131-A3
    - 4) OCC DZ024TSLX9YPI8
- 9. Non-Armored 24 Strand Single-Mode Fiber:
  - a. 24 Fiber Plenum/Outdoor Rated Distribution Cable Product:
  - b. For general use where allowed by Code.
  - c. Acceptable Product:
    - 1) Belden FDSD024P9
    - 2) Clark CWF-D024SMP
    - 3) Commscope 760037218 | P-024-OD-8W-FSUBK
    - 4) Corning 024ZUZ-T4101D20
- C. Connectors
  - 1. LC Connector
    - a. LC Splice on connector
    - b. Indoor/Outdoor rated
    - c. 0.3 db maximum insertion loss
    - d. Acceptable Product
      - 1) Belden FTSLC900FS01

## 2.15 POWER SYSTEMS

- A. Power Sequencing
  - 1. Power Sequencing system to be operated via low voltage button contact closures from either push buttons located on panels local to the event space or via a contact closure from a remote control system (DSP, Control Processor, etc.)
  - 2. Devices to be sequenced "ON" in order of audio signal flow. Devices and equipment to be shut down in reverse order from "ON" sequence. Example "ON" order starting with:
    - a. Source devices. (Media Players, Pre-amplifiers, etc.)
    - b. Processing devices (DSP, Mixers, Video Switchers, etc.)
    - c. Output devices (Amplifiers, Powered Speakers, etc.)
  - 3. Devices not to be sequenced and to remain on for status and monitoring purposes to include but not limited to:
    - a. Network switches and components.
    - b. Equipment housing ventilation systems.
    - c. Control system equipment responsible for providing control of Remote Power Sequencing system.
- B. Rack Power Distribution (RPD, Type 1)
  - 1. Rack mountable vertical distribution.
  - 2. Used for additional outlets where needed.
  - 3. Size strip to number of required outlets.
  - 4. Acceptable Product:
    - a. Middle Atlantic PDT Series
    - b. Middle Atlantic PD Slim Series
- C. Power Protection with Lights (POWER/LIGHT):
  - 1. 20 Amp power system.
  - 2. Eight switched AC outlets.
  - 3. Acceptable Product:
    - a. Furman Sound PL-PRO C
    - b. Approved Equivalent

- D. Rackmount Uninterruptible Power Supply (UPS)
  - 1. Provide UPS systems to maintain power to all networking and processing equipment, including digital audio mixer systems and recording equipment.
  - 2. UPS's shall be on-line style with sufficient battery reserve to operate for 15 minutes. Size each UPS unit for 25% additional capacity.
  - 3. Rack mountable.
  - 4. Acceptable Product:
    - a. Middle Atlantic Select Series UPS
    - b. APC Easy UPS Series

## 2.16 EQUIPMENT HOUSING AND ACCESSORIES

- A. General
  - 1. Refer to drawings for equipment rack sizes and additional notes.
- B. Floor-Supported Wall Rack (Type 1)
  - 1. Finish: Black powder coat
  - 2. Tapped 10-32 rack rails
  - 3. Acceptable Product:
    - a. Middle Atlantic SR series
      - 1) Middle Atlantic DWR-FK6 series
      - 2) Middle Atlantic LVFD series
- C. Rack Blanks (BLANK)
  - 1. Flanged, aluminum panel.
  - 2. Anodized finish.
  - 3. Acceptable product:
    - a. Middle Atlantic BL series
- D. Rack Vents (VENT)
  - 1. Flanged, aluminum panel.
  - 2. Anodized finish.
  - 3. Acceptable product:
    - a. Middle Atlantic VTP series
- E. Cable Management
  - 1. Brush grommet panel
  - 2. Acceptable Product:
    - a. Middle Atlantic BR series
- F. Rack Drawers (DRAWER)
  - 1. Blank anodized finish
  - 2. Acceptable product:
    - a. Middle Atlantic D series
- G. Rack Mounted Sliding Shelf (SLIDE OUT SHELF)
  - 1. Finish: Black
  - 2. 1-RU rack mountable sizes.
  - 3. Acceptable product to include:
    - a. Middle Atlantic SS
- H. Equipment Rack Screws:
  - 1. Install rack mounted equipment with black 10-32 star post security screws with flat nylon washers.
  - 2. Quantity as required.
  - 3. Provide one spare bit located in a clear plastic bag attached to the inside of each equipment rack in plain view.
  - 4. Acceptable Product:
    - a. Middle Atlantic HTX

## 2.17 PLATES AND PANELS

- A. General

1. Provide plates and panels and as described in Drawings. Engrave as shown on Drawings. Other Plates and Panels may be required to satisfy the requirements of the Work.
2. Custom panels shall be 1/8-inch thick aluminum, standard EIA sizes, brushed, anodized finish unless otherwise noted. Brush in direction of aluminum grain only.
3. Plate finish shall be coordinated with the Owner. Plastic plates are not acceptable.
4. Panel, plate and label engraving shall be 1/8-inch block sans serif characters unless noted otherwise. On dark panels or pushbuttons, letters shall be white; on stainless steel or brushed natural aluminum pushbuttons, letters shall be black.

B. Custom and/or Engraved Panels:

1. Custom panels constructed of 1/8 inch brushed aluminum
2. Coordinate finishes with Owner
3. Acceptable Manufacturers:
  - a. EMG
  - b. RCI Custom
  - c. ProCo
  - d. Radial Engineering

## 2.18 CONNECTORS

A. XLR Panel mount Connectors

1. Provide panel mount XLR connectors with unified metal shell.
2. RF-Protector connectors.
3. Shell Color: Black.
4. Contacts: Silver.
5. Terminations: Solder.
6. Acceptable Product:
  - a. Male Connectors: Neutrik NC\*MD-L-1-BAG Series
  - b. Female Connectors: Neutrik NC\*FD-L-1-BAG Series

B. XLR Cable Connectors

1. Provide XLR cable connectors with die cast shell.
2. No-screw type assembly.
3. Chuck-type strain relief.
4. Shell Color: Black.
5. Contacts: Silver.
6. Terminations: Solder.
7. Acceptable Product:
  - a. Male Connectors: Neutrik NC\*MX-BAG Series
  - b. Female Connectors: Neutrik NC\*FX-BAG Series

C. Speaker Connectors

1. Provide 4 or 8 conductor connector
2. Shell Color: Black
3. Terminations: Solder or tab
4. Acceptable Product:
  - a. Neutrik NL4MPXX
  - b. Neutrik NL8MPRXX

D. BNC Cable Connectors

1. Provide cable mount BNC connectors.
2. Contacts: Brass or copper.
3. Terminations: Crimp.
4. Acceptable Product:
  - a. Kings
  - b. Amp
  - c. Amphenol
  - d. Canare
  - e. Liberty

E. Ethercon Panel Connectors

1. Provide panel mount Ethercon CAT6 connectors
2. Metal housing
3. Shielded

4. Acceptable Product:
  - a. Neutrik NE8FDP-B

## 2.19 LOOSE CABLES

### A. Microphone/Instrument Cables:

1. Cable properties:
  - a. Quad 24 gauge stranded with braided shield, flexible hard service jacket.
  - b. Color: Black
  - c. Each cable to be provided with a Velcro style tie wrap.
    - 1) Minimum 5/8" width
    - 2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-inch diameter.
    - 3) Standard of performance:
      - a) Rip-Tie CABLEWRAP
2. Microphone Cable:
  - a. Type 06 – 6 foot, with Gray collar on connector
  - b. Type 25 – 25 foot, with Blue collar on connector
  - c. Type 50 – 50 foot, with Green collar on connector
  - d. Type 100 – 100 foot, with Red collar on connector
3. Instrument Cable
  - a. Type 06 - 6 foot, 1/4-1/4
  - b. Type 10 – 10 foot, 1/4-1/4
4. Acceptable cable:
  - a. Whirlwind MKQ series
  - b. Canare StarQuad
  - c. ProCo AmeriQuad

### B. Intercom Cables:

1. Cable properties:
  - a. 6 conductor 24 gauge stranded with braided shield, flexible hard service jacket.
  - b. Color: Black
  - c. Each cable to be provided with a Velcro style tie wrap.
    - 1) Minimum 5/8" width
    - 2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-inch diameter.
    - 3) Standard of performance:
      - a) Rip-Tie CABLEWRAP
2. Intercom Cable:
  - a. Type 06 – 6 foot, with Gray collar on connector
  - b. Type 25 – 25 foot, with Blue collar on connector
  - c. Type 50 – 50 foot, with Green collar on connector
  - d. Type 100 – 100 foot, with Red collar on connector
3. Acceptable cable:
  - a. Whirlwind MK6CC series
  - b. Approved Equivalent

### C. Speaker Cables:

1. Cable properties:
  - a. Color: Black,
  - b. Connector: NL4 to NL4 or NL8 to NL8
  - c. Wire: 12 gauge stranded, SJ jacket.
  - d. Each cable to be provided with a Velcro style tie wrap.
    - 1) Minimum 1" width
    - 2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-18 inch diameter.
    - 3) Standard of performance:
      - a) Rip-Tie CABLEWRAP
2. Speaker Cable:
  - a. Type 06 – 6 foot, with Gray collar on connector
  - b. Type 25 – 25 foot, with Blue collar on connector
  - c. Type 50 – 50 foot, with Green collar on connector
  - d. Type 100 – 100 foot, with Red collar on connector
3. Acceptable cable:
  - a. Whirlwind NL series
  - b. Approved Equivalent



D. Ethernet Audio Cables:

1. Cable properties:
  - a. Color: Black
  - b. Neutrik Ethercon Connector
  - c. Rugged Tactical Jacket
  - d. Each cable to be provided with a Velcro style tie wrap.
    - 1) Minimum 5/8" width
    - 2) Length appropriate to wrap minimum 1.5 times around a cable loop of 14-inch diameter.
    - 3) Standard of performance:
      - a) Rip-Tie CABLEWRAP
2. Ethernet Audio Cable:
  - a. Type 06 – 6 foot, with Gray collar on connector
  - b. Type 25 – 25 foot, with Blue collar on connector
  - c. Type 50 – 55 foot, with Green collar on connector
  - d. Type 100 – 100 foot, with Red collar on connector
3. Acceptable cable:
  - a. ProCo DuraCat
  - b. Approved Equivalent

## 2.20 INSTALLED CABLES & WIRING

A. General

1. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g. CMR, CMP, etc.)
2. Cable shall carry appropriate fire rating (e.g. CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.
3. Where cables are routed through cable tray, provide tray rated cable of equal specification.
4. Where speaker cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.
5. Shielded cables located in raceways shall have aluminum foil shield with drain wire.
6. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from West Penn, Windy City Wire, Liberty, Commscope and Gepco are also acceptable provided they meet the performance specifications of the approved listed cables.

B. Microphone/Line Level Wire

1. Provide shielded 22 AWG cable.
2. Cable to be PVC jacketed.
3. Jacket color: black.
4. Acceptable Product:
  - a. Belden 9451

C. Production Intercom Wire

1. 18 AWG shielded
2. Cable capacitance to be less than 17 pF/ft
3. Acceptable Product:
  - a. Belden 6340FT
  - b. Belden 9207

D. Speaker Level Wire

1. For applications less than 300W and/or 300 feet
2. Provide 16 AWG cable.
3. Cable to be CL3R or CL2P rated.
4. Jacket color: gray.
5. Acceptable Product:
  - a. Belden 5200UE

E. Category Cable

1. 23-gauge solid cable
2. Category 6+ Enhanced
3. 4 pair, UTP
4. Acceptable Product:
  - a. Belden 2412F

- F. Wireless /Assisted Listening Antenna Cable
  - 1. For applications less than 100 feet
  - 2. 16-gauge, stranded center conductor
  - 3. RG8/X
  - 4. 95% braided shield
  - 5. Acceptable Product:
    - a. Belden 9258
- G. Wireless /Assisted Listening Antenna Cable
  - 1. For applications between 100 and 400 feet
  - 2. 10-gauge, stranded center conductor
  - 3. RG8/U
  - 4. 90% braided shield
  - 5. Acceptable Product:
    - a. Belden 9913

## 2.21 MISCELLANEOUS

- A. Headphones (Type 1):
  - 1. Acceptable Product:
    - a. Sony MDR-7506
    - b. Shure SRH440
    - c. Approved Equivalent
- B. Patch Panels:
  - 1. Identification strips to be printed labels of different color for each major connector grouping. Use a combination of colored fonts on white background and black fonts on colored backgrounds.
  - 2. Video and AES (unbalanced) patch panel with normal through patch jacks.
    - a. Acceptable Products
      - 1) Bittree B96H-2MVNHD. (Quantity: As required with 10% excess capacity)
      - 2) Equivalent products from AVP are also acceptable
  - 3. Audio Patch Panels—
    - a. Non-terminated inputs to be shorted through normalling contacts on rear panel.
    - b. Provide one punch down tool and one replacement tip.
    - c. Acceptable product:
      - 1) Bittree B96DC-HNSSH/E3 M2OU7B
      - 2) Equivalent products from AVP and ADC are also acceptable
        - a) Provide additional panels for termination of existing, external cabling; terminations at patch panels by video production system Contractor.
  - 4. Fiber Optic Patch Panels (SMFO PANEL)
    - a. Enclosure
      - 1) Corning CCH-01U
      - 2) Quantity: As Required
    - b. Adapter Plates
      - 1) Corning CCH
      - 2) Quantity: As Required
  - 5. Category 6 patch panel:
    - a. Provide quantity as required for connections & patching of network cabling
    - b. Modular style panel
    - c. 48 ports per 1U rack space
    - d. Loaded with Category 6 RJ-45 jacks with colors to match workstation end.
    - e. Blank inserts in unused ports.
    - f. Acceptable products:
      - 1) Panduit
        - a) 48 port Part # CPP48HDWBL Y
      - 2) Substitutions: Under provisions of Division 01
  - 6. Category 6A patch panel:
    - a. Provide quantity as required for connections & patching of network cabling
    - b. Modular style panel
    - c. 24 ports per 1U rack space
    - d. Loaded with white Category 6A RJ-45 jacks to support installed cables
    - e. Blank inserts in unused ports
    - f. Acceptable products
      - 1) Panduit

- a) 48 port Part # CPP48HDWBLY
- 2) Substitutions: Under provisions of Division 01

## PART 3 - EXECUTION

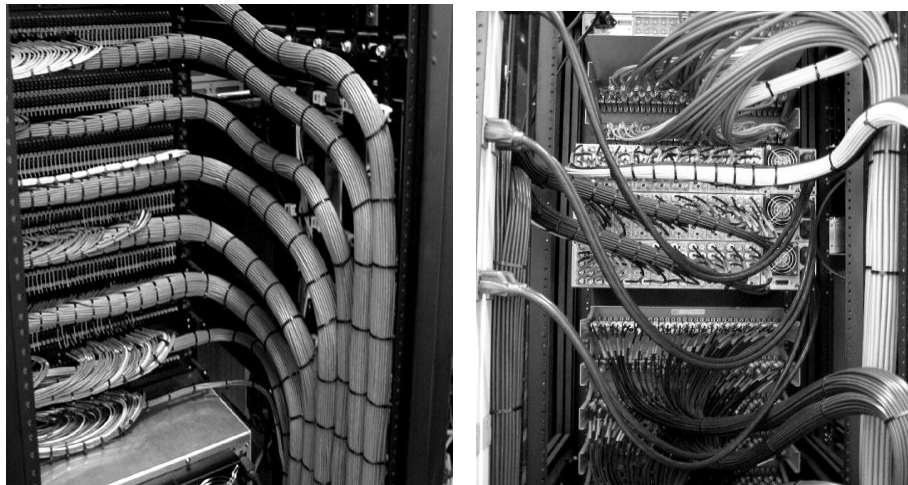
### 3.1 GENERAL

- A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final Products.
- B. The installation recommendations contained within ASDI and Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.
- C. Mount equipment and enclosures plumb and level.
- D. Permanently installed equipment to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic bracing shall be installed on appropriate equipment where local codes require such installation.
- E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

### 3.2 INSTALLATION

- A. Installation of cable and wiring
  - 1. Cabling and Wiring:
    - a. Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
    - b. Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
    - c. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
    - d. Horizontal distribution cables shall be bundled in groups of no more than 50 cables when being supported by J-Hook or trapeze systems. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance. An exception to this rule is when cable is installed in cable tray systems.
    - e. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices
    - f. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
    - g. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.
    - h. Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
    - i. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
    - j. Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.
    - k. Make joints and connections with rosin-core 60/40 solder or with mechanical connectors specifically intended for the type and class of cable being used. Where spade lugs are used, crimp properly with ratchet type tool.
    - l. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signal, float cable shield at one end. Shield not connected to be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
    - m. Isolate cables and wires of different signals or different levels; and separate, organize, and route to restrict channel crosstalk or feedback oscillation in any amplifier section. Keep wiring separated into groups for microphone level circuits, line level circuits, loudspeaker circuits, and power circuits.
    - n. Connect cable to active components through XLR connections whenever multiple formats are available. Make connections to speaker transformers with properly sized closed end connectors

- crimped with factory approved ratchet type tool. Wire nut or "Scotchlock" connectors are not acceptable. Do not wrap audio cable splices or connections with adhesive backed tape.
- o. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
  - p. Execute wiring in strict adherence to:
    - 1) Phillip Giddings. Audio System Design and Installation. Indianapolis: Howard W. Sams & Co., 1990.
    - 2) Don Davis and Carolyn Davis. Appendix II, Recommended Wiring Practices. Sound System Engineering, 2nd Edition. Indianapolis: Howard W. Sams & Co., 1989.
    - 3) AV Installation Handbook Second Edition: The Best Practices for Quality Audiovisual Systems, Infocomm, 2009
2. Equipment Housing Cabling and Wiring:
- a. Lace, tie, or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire or cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack but still allow for service and testing. Provide horizontal support bars if cable bundles sag. Reference photos below for standard of quality.



- b. Provide adequate service loops so that equipment mounted on rack slides may be pulled fully out, to their locked position without straining cable.
  - c. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
  - d. Provide plastic cable ties or Velcro straps to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
  - e. Install with connections completely visible and labeled.
  - f. Provide termination resistors, if required, of 5 per cent tolerance; fully visible and not concealed.
- B. Installation of connectors, plates & panels:
- 1. Install panel mounted connectors rigidly attached to panels, plumb and level.
  - 2. Custom rack panels shall be 1/8 inch thick aluminum, standard EIA sizes, brushed black anodized finish (brushed in direction of aluminum grain only), unless otherwise noted.
  - 3. Custom connector plates (speaker, microphone, etc.) are typically stainless steel, unless otherwise noted or specified. However, verify plate finish with Architect.
  - 4. Install XLR type connectors in accordance with IEC-268 standard, with a wiring scheme of pin 2 hot (high), pin 3 (low), and pin 1 screen (shield).
  - 5. Other Plates and Panels may be required to satisfy the requirements of the Work.
- C. Installation power and grounding:
- 1. Coordinate final connection of power and ground wiring to housings.
  - 2. Hardwire power wiring directly to internal AC receptacles to ensure uninterrupted operation.
  - 3. Provide 3-conductor, isolated ground, 120 VAC outlets as required within each housing. Provide a minimum of two spare outlets in each rack.
  - 4. Provide a copper ground buss top to bottom in each housing, insulated from the housing. Ground equipment chassis not having a three wire power cord to these busses using 6/32 nuts, bolts and lock-washers with No. 12 wire. Connect green ground wire from each AC outlet in housing to this buss bar.

5. Replace manufacturers supplied 18 gauge IEC power cords with UL listed 18 gauge pre-molded 6", 12", 18", or 24". Use minimum length required. No looped or cable tied IEC power cords will be permitted within the equipment rack.
  6. Replace manufacturers supplied 14 gauge IEC power cords with UL listed 14 gauge pre-molded 18" or 36" for all equipment IEC capable. Use minimum length required and minimize looped or cable tied IEC power cords present in the equipment rack.
- D. Installation of electronic equipment:
1. Take appropriate precautions against electrostatic discharge (ESD). Establish a personal ground before handling electronic equipment through the use of a grounded wrist wrap and/or an anti-static floor pad.
  2. Take appropriate precautions to protect the equipment from damage during installation. Equipment to be installed free of damages, scratches, dents, etc.
  3. Mount trim potentiometers, custom circuit cards, relays, and transformers (except large 70V units) in shielded enclosures, and mark their function and connections with engraved lamicoid labels.
  4. Mount equipment plumb and level, firmly and safely held in place.
- E. Installation of equipment housing:
1. Mount equipment in racks and consoles and fully wire and test before delivery to job site. If field conditions prevent prior assembly of racks, notify Owner in writing that racks will be fabricated on site and the reasons for the change.
  2. Secure rack mounted devices utilizing all available fastener mounting positions on device.
  3. Provide rear support for housing mounted equipment greater than 15 inches deep.
  4. Provide blank panels to fill unused panel space within the equipment housing.
  5. If Key door locks are required, key each housing type alike.
  6. Looking at the rack from the rear, locate AC power and speaker wiring on the left; line level audio, video, and RF wiring on the right.
  7. Provide shaft locks or security covers on non-user operated equipment having front panel controls. These panels are to be installed at the conclusion of testing.
  8. If forced air active thermal management is used, provide ventilation blocking material on the front, sides, and rear of the equipment rack as needed. Reference Middle Atlantic Products "Controlling the Temperature Inside Equipment Racks".
  9. Panels or equipment mounted on the rear rack rails shall not block access to any front mounted components.
  10. If equipment rack is not equipped with casters, provide two inch high wood base to isolate equipment rack from floor. Wood base should be capable of supporting the load.
- F. Installation of loudspeakers:
1. The Contractor is responsible for final design and engineering of loudspeaker rigging, attachments, brackets, and hoisting.
  2. Loudspeakers shall be mounted at the operating position in a safe, secure, and permanent manner.
  3. Provide custom rigging as needed.
  4. Suspension and Mounting:
    - a. Static and dynamic equipment loads shall be suspended or mounted in compliance with the following ANSI/ESTA standards, using the latest available versions of the standards:
      - 1) ANSI E1.4-2-2021 Statically Suspended Rigging Systems
      - 2) ANSI E1.56-2018 Rigging Support Points
      - 3) ANSI E1.6-1-2021 Powered Hoist Systems
      - 4) ANSI E1.8-2012 Loudspeaker Enclosures Intended for Overhead Suspension
    - b. Rigging, mounting, and support systems for overhead suspended loudspeakers shall be reviewed and certified by a registered Professional Engineer (PE), in the employ of the Contractor, licensed to practice in the State in which the project is located. Documentation shall be included as a submittal item. Once the systems are installed, the PE shall physically inspect, at the Contractor's cost, the methods and means used to verify compliance with the original design.
  5. General Guidelines:
    - a. Paint loudspeakers, supports, and related hardware color as directed by the Owner.
    - b. The aiming direction of all loudspeakers shall be adjustable by no less than  $\pm 5$  degrees horizontally and vertically.
    - c. Loudspeakers are to be oriented parallel to their mounting surface unless otherwise noted.
    - d. Provide a safety cable connected to a secondary location for each loudspeaker.
    - e. All loudspeakers located in ceiling tiles shall be located in the center of the tile unless noted otherwise.
    - f. Paint loudspeakers to match surroundings. Confirm color selection with the Architect during the submittal phase.

- g. Exterior loudspeaker cabinets shall be constructed of materials designed for permanent outdoor exposure conditions with a minimum IP 54 rating, and a minimum expected 10-year life span. Exterior and interior surfaces of the cabinets shall be protected from the effects of water, moisture, and humidity. The exterior surface shall also be protected from the effects of ultraviolet radiation to prevent fading and color change. The cabinets shall be shaped and oriented in a manner that minimizes the possibility of water pooling on any cabinet surface. Associated hardware shall be inherently non-corrosive, performing to the standards of 304 Stainless Steel or higher.
- G. Installation of projectors:
  - 1. Confirm distance of specified projection lens before mounting projector.
  - 2. Projectors shall be mounted plumb and level at the operating position in a safe, secure and permanent manner.
  - 3. All hardware required to locate the mount and projector at the required location shall be provided.
  - 4. Projectors shall be mounted using tamper proof secure hardware.
  - 5. Contractor may be required to adjust projection screen and lift upper and lower limit switches for projection screens and lifts specified elsewhere and not installed as part of this Contract.
- H. Installation of flat panel monitors:
  - 1. Confirm location before mounting.
  - 2. Monitors shall be mounted plumb and level at the operating position in a safe, secure and permanent manner.
  - 3. All hardware required to locate the mount and monitor at the required position shall be provided.
  - 4. Locate monitor on the center line of the room unless noted otherwise.
- I. Loose Equipment
  - 1. Provide loose equipment as indicated on drawings.
  - 2. Unpackage and assemble items.
  - 3. Place items in designated storage or refer to Owner for direction on final location and storage of loose equipment.

### 3.3 FIRESTOP

- A. A fire-stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Fire-stop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire-stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire-stopped.
- C. Fire-stop systems shall be reviewed by a Professional Engineer (PE) licensed to practice in the State in which the project is located. Stamped drawings showing the fire stop systems shall be included as a submittal item. Once the systems are installed, the engineer of record for the firestop system shall physically inspect the methods and means used to verify compliance with the original design.
- D. A drawing showing the proposed fire-stop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the fire-stop system(s).
- E. All fire-stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for observation by the local authorities prior to cable system acceptance.

### 3.4 CONTROL SYSTEM PROGRAMMING

- A. Transport Control
  - 1. Provide standard Stop, Play, Pause, Fast Forward and Rewind for each playback device and menu control for DVD players. Buttons should be arranged in a conventional fashion that will be familiar to the normal user.
  - 2. The selected control function should be displayed by showing the appropriate button "pressed". It should remain this way until another function is selected.
  - 3. For devices that will go into a standby mode after a period of time, the control system shall sense this mode and restore normal operating mode once a transport function has been selected. This may

require the use of current sensors to determine the state of the unit. No direct user action should be required at the playback device to restore the normal operating mode.

B. Screen/Shade Control

1. In addition to up-down functions, provide a Stop function to allow the movement to be halted. Once movement has been stopped, the up or down buttons should resume travel in the selected direction.
2. Control system shall not prevent screen/shade wall controls from being used as well.
3. Touch panel controls should be readily accessible to the user to permit direct control of shades or screen with having to navigate through multiple control pages.

C. Room Combining

1. Combining of adjacent areas shall be done through a graphical representation of the physical areas to be combined. Use of a floor plan metaphor is recommended with the graphic oriented correctly with respect to control panel location.
2. Use buttons or other appropriate objects placed along the common wall to enable the combining function.
3. When spaces are combined, the graphic appearance of those areas shall change to reflect this configuration. Once an area is separated from a combination, the color of its area should revert to the normal room color.
4. Common control functions between combined rooms shall be linked, allowing control of the combined area from any one of the touch panels. Examples of common functions include:
  - a. Background music selection,
  - b. Background music volume
  - c. Background music muting
  - d. Lighting preset recall
  - e. Master volume (not individual channel volume)
5. When combining adjacent rooms, the control system shall force the common functions to a predetermined default configuration so all rooms have the same configuration.
6. To avoid unintentional changes, a control panel will not be able to operate a function in a remote location without also operating that same function in the room where the panel is located.

D. Level Control

1. Objects requiring level adjustment such as volume or tone controls shall be through Up/Down buttons with a graphical representation of the actual level.
2. Increment of level change to be adjusted for reasonable range without the need to push the Up or Down buttons needlessly.

E. Volume Mute

1. Where the ability to mute the sound is needed, the button shall use the label "Vol On" and "VOL OFF" instead of Mute and Unmute. When in a "VOL OFF" mode, pushing the "VOL UP" button shall restore the sound and bring the system out of the muted mode.
2. VOL ON/OFF buttons shall change color to indicate the status of the button.

F. Standard Colors

1. Control functions shall be color coded to add clarity and show relationships between different groups of controls.
2. The color Red shall be reserved to indicate a fault or abnormal condition.
3. Green may be used to indicate normal operation, but may be used for standard control colors as well.
4. Similar controls should maintain the same color scheme across all control pages.
5. When a function is selected, the graphical depiction of that button should appear to be pressed and its color change to a darker shade of the regular button color.
6. Color schemes used for background and foreground objects should be selected to be complimentary and provide a consistent theme throughout the control pages.

G. Minimum Button Size and Placement

1. Minimum visual size of a button is 3/8" wide by 1/4" high.
2. Spacing between buttons should be no less than 1/16".
3. Where buttons are immediately adjacent, the active selection area of the button should be reduced to 80% of the visual area of the button.

H. Button Actions

1. When a function on a control page is selected, that button or visual object associated with that function should change to reflect what has been chosen.

2. For functions that are momentary selections (i.e., VOL UP), the change of state is visible for as long as the button is being pressed.
3. For function that are maintained selections (i.e., PLAY), the change of state remains visible until another function is selected and resets the previous function.
4. The state change of a button or visible object should depict real-world objects as much as possible including the appearance of the button be pressed inward, change in shade of the original color, but not a change in hue.

I. Labels

1. Use of simple words or titles are preferred to indicate functionality, navigation and system status.
2. Use of stylish symbols should be avoided unless their identity is commonly recognized by the general public. Standard symbols for transport functions are acceptable.
3. Labels should be presented in a clear, sans serif type face that will remain legible on lower resolution touch panels.
4. Where physical buttons are present along the side of a touch panel, these buttons should be engraved and filled with a contrasting color.

J. Power On/Off

1. For panels requiring an ON/OFF control, these functions should be linked through current sensors or other methods for the control system to detect the power on condition of the component being controlled.
2. Powering off a system should not interfere with the ability of a projector to complete its cool down cycle.

K. Look & Feel

1. Control pages should utilize a clean, elegant but stylish appearance.
2. Use a common graphical template across all control pages for a consistent look.
3. The touch screen layout should utilize graphical elements such as drop shadows, gradient fills and transparency to provide a pleasing overall appearance.
4. Utilize graphical representations of floor plans to convey location information.
5. Include company logos, icons or watermarks to portray the corporate identity.
6. Provide clear navigation tools for moving between control pages.
7. Each sub-page should have a "BACK" button to return to the previous page. This button should appear in the same location on each page.
8. Provide a "HELP" button or icon on each user page to provide clear, non-technical instructions on how to use the functions available to regular users.

L. Security

1. Provide password access to control pages not intended to be accessed by the general public.
2. Unless otherwise noted, provide a minimum of three levels of access
  - a. General User
  - b. Non-Technical Employee
  - c. AV Technician
3. Segregate the control functions to only allow authorized individuals access to more sophisticated control pages.
4. Provide a timeout feature to automatically return the control panel back to the default opening screen after 30 seconds of inactivity. After this reset, passwords must be reentered to return to a previous control page.

M. Presets

1. For systems that have different operating modes or configurations, provide the ability to store and recall preset combinations of system settings.
2. Provide a "Preset" page that permits a minimum of five presets to be recalled. Each button to include a label describing the function or configuration associated with that button.
3. Provide the ability for new presets to be stored over previous settings. New preset to be able to change the label to reflect the new or revised configuration.
4. When a preset has been recalled, the control page should indicate the active configuration.

### 3.5 LABELING OF EQUIPMENT

- A. Provide each terminal strip with a unique descriptor and a numerical designator for each terminal. Show terminal strip descriptor and designator on system schematic drawing.
- B. Provide logical and legible cable and wiring label permanently affixed for easy identification.



1. Labels on cables to be adhesive strip type covered with clear heat-shrink tubing. Factory stamped heat shrink tubing may be used in lieu of the adhesive strip style.
2. Wiring designator to be an alpha-numeric code unique for each cable. Actual cable designation assignments to be determined by Contractor. Add cable designation codes to system schematic drawings.
3. Locate the cable designator at the origination and destination of each circuit within 3 inches of the point of termination or connection. Provide cable designator on circuits with intermediate splice points with an additional suffix to indicate each segment.

### 3.6 ENGRAVING

- A. Text font: 1/8 inch block sans serif characters unless noted otherwise.
- B. On dark materials, provide white characters; on stainless steel or brushed natural aluminum plates, or light-colored materials, provide black characters.
- C. Provide at least two lines of text with first line listing the general device name, e.g., amplifier. Second line to include schematic reference of the device, e.g., AMP-1.
- D. Equipment label: black with white characters except where indicated.

### 3.7 COMMISSIONING

- A. Prior to energizing or testing the system, ensure the following:
  1. All products are installed in proper and safe manner according to manufacturer's instructions.
  2. Insulation and shrink tubing are present where required.
  3. Dust, debris, solder splatter, etc. is removed.
  4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
  5. Labeling has been provided.
  6. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
  7. Products are neat, clean and unmarred and parts securely attached.
  8. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.
- B. Prior to energizing the System verify and perform the following tests and adjustments in compliance with applicable EIA standards.
  1. Electronic devices are properly grounded.
  2. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
  3. Verify each individual component is operating properly.
  4. Verify each individual component's performance meets the manufacturer's published performance for this unit.
  5. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
- C. Speaker Circuit Verification Test
  1. Measure the impedance of each speaker line leaving the equipment racks.
  2. For constant voltage systems measure the impedance at 100 (or 250) Hz, 1 KHz and 8 (or 10) KHz of each line leaving the equipment rack with the line disconnected from the driving source. For band limited devices, use a frequency appropriate for the operating range of the transducer.
  3. When documenting the results of these tests, include the calculated impedance based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedance.
  4. Include the results of the tests in the Project Record Manual.
- D. Speaker Polarity Verification Test
  1. Use an electronic polarity checker, TEF-20, SYSID, SIM II, Smaart, or other similar device to test each loudspeaker. All speakers should have the same relative polarity.
  2. Follow manufacturer's recommendations in conducting the tests.
  3. Include the results of the tests in the Project Record Manual.
- E. Audio Signal Paths
  1. Verify operation from each source device through all switching, amplification and distribution devices.

- F. System Gain Adjustment
  - 1. Adjust each active device to have proper gain structure from the mixer output to the input of the amplifier.
  - 2. With all amplifiers turned off, connect a sine wave or pink noise generator to the input of the mixer. Using an RMS AC voltmeter with a dB scale, adjust the mixer to an output between -10 and 0 dBu. Once the level has been established, it should remain unchanged throughout the test. All equalizers should be set flat for this test.
  - 3. Follow the signal flow from the mixer to each subsequent component. Measure the input level and output level of each device at the point of connection to the device. The input level reading should differ no more than 0.25 dB from the level recorded for the preceding device. Diagnose and correct the wiring or equipment when any readings exceed this range.
  - 4. Adjust the output of each component to achieve the proper output level.
  - 5. Record the output levels of each device in the Project Record Manual.
- G. Signal Delay Adjustment
  - 1. Adjust the delay to each subsystem to ensure proper synchronization between the main speakers and delayed speakers.
  - 2. Using a TEF 20, SYSID, Smaart, SIM II, or other acceptable time based measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal.
  - 3. Based on the arrival times measured, adjust the delay applied to the local speakers to synchronize them with the distant speakers. Repeat the test to verify the delay has been set to within 1 ms of the arrival of the distant signal. Once the precise delay time has been determined, provide an additional 10 ms of Haas effect delay to maintain directional orientation toward the original sound source.
  - 4. Continue to test and adjust each separate subsystem with a dedicated delay channel.
  - 5. Provide hard-copy printout of each delay adjustment showing first the arrival times with no delay set and then the result after the delay has been adjusted. Record the settings of each delay in the Project Record Manual.
- H. Remote Input Verification Test
  - 1. Using a microphone or portable signal generator, connect to each microphone/line level receptacle throughout the facility.
  - 2. Verify that the receptacle under test appears at the correct input and is operating properly.
  - 3. In a similar manner, check all remote tielines and media related lines for correct wiring and labeling.
- I. System Equalization
  - 1. Using a RTA, TEF 20, SYSID, or SMAART, equalize all loudspeaker systems to provide a suitable frequency response as follows:
    - a. Speech Reinforcement Systems: flat response from 125 Hz to 2.5 KHz, with 2 dB roll off above.
    - b. Program Reproduction Systems: flat response from 65 Hz to 8 KHz, with 2 dB roll off above.
  - 2. Verify system gain and amplifier levels.
  - 3. Provide program levels of at least 85 dB and speech reinforcement levels of at least 70 dB in the seating area without objectionable distortion, buzzes, or rattles.
  - 4. Provide hard copy printouts of the spectral response with the test data.
- J. RFI and Parasitic Oscillation
  - 1. With systems operating check to ensure that all systems are free from spurious oscillation and radio frequency interference in the absence of audio signal.
- K. Buzzes, Rattles and other Distortions
  - 1. Adjust the system for normal operating level in the space. Apply a slow sine wave sweep from 60 Hz to 3 KHz and listen carefully for buzzes, rattles and other objectionable distortions.
  - 2. Correct the cause of the defect. If the cause is not from the system. Bring the cause to the attention of the GC, indicating cause and suggestive corrective actions.
- L. Video Systems Test
  - 1. Projected images and screen must be plumb with respect to ceiling line.
- M. Video System Tests. Verify performance of all video equipment, components and systems, as specified herein.
  - 1. Video (signal):
    - a. S/N (peak to RMS), unweighted DC to 4.2 MHz: 55 dB minimum.
    - b. Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum.
    - c. Frequency Response: Within plus to minus 0.5 dB to 4.2 MHz.
    - d. Line and Field Tilt: 2% maximum.

- e. Differential Gain: 2% maximum.
  - f. Differential Phase: 2 degrees maximum.
  - g. Frequency Response: DC to 4.2 MHz within plus or minus 0.5 dB.
- N. Video Signal Paths
  - 1. Verify operation from each source device through all switching, amplification and distribution devices.
- O. Video Test Report shall include the following:
  - 1. Test Failures and Notices
    - a. Sink Device EDID Test – Open items or failures shall not be accepted.
    - b. Cable Length Test – Open items or failures shall not be accepted.
    - c. HDCP KSV Limitations – Limitations shall not be accepted.
    - d. Cable Limitations - Limitations shall not be accepted.
    - e. EDID Limitations - Limitations shall not be accepted.
    - f. Cable Length Limits exceeded – Failing cables shall not be accepted.
  - 2. Device Model Number, Serial Number, and Firmware Version for main chassis and each input and output card.
  - 3. Device Model Number, Serial Number, and Firmware Version for connected transmitter and receiver devices.
  - 4. EDID – Input Resolution and 3D support status for each input.
  - 5. EDID – Supported Output Resolution and 3D support status for devices connected to each output.
  - 6. EDID – Supported Audio formats for each input.
  - 7. EDID – Supported Audio formats for devices connected to each output.
- P. Control Systems
  - 1. Verify operational functions of the control system and all interfaced devices.
  - 2. Verify operational functionality of any wireless user devices.

### 3.8 CAT5E/CAT6 CABLE CERTIFICATION

- A. General Field Test Requirements
  - 1. All CAT5E/CAT6 cabling links installed as part of this scope shall be tested for the following, in accordance with the field test specifications defines in ANSI/TIA-568-C.2 "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard." This document will be referred to as the "Category 5e Standard":
    - a. Wire Map
    - b. Length
    - c. Insertion Loss
    - d. NEXT loss
    - e. PS NEXT Loss
    - f. ACR-F Loss
    - g. PS ACR-F Loss
    - h. Return Loss
    - i. Propagation Loss
    - j. Delay Skew
  - 2. The installed twisted-pair horizontal links shall be tested from terminated end point to terminated end point for compliance with the "Permanent Link" performance specification as defined in the Category 5e Standard.
  - 3. One hundred percent of the installed cabling links must pass the requirements of the Category 5e standard mentioned above and as further detailed in Section B below. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with Section C below.
  - 4. The test equipment (tester) shall comply with the accuracy requirements for level IIe field testers as defined in ANSI/TIA-1152. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 2 of ANSI/TIA-1152 (Table 2 in this TIA document also specifies the accuracy requirements for the channel configuration).
  - 5. The RJ45 test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.
  - 6. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
  - 7. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum

accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

8. The Pass or Fail condition of the link-under-test is determined by the results of the required individual tests (detailed in Section 4.2.2 of ANSI/TIA-1152). Any Fail result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass.
9. A Pass or Fail result for each parameter is determined by comparing the measured values with the specifies test limits for that parameter.

**B. Performance Test Parameters**

1. The test parameters are defined by the Category 5e Standard. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test, all measurements (at each frequency in the range from 1 MHz through 100 MHz) must meet or exceed the limit value determined in the above mentioned standard.
2. Wire Map - Shall report Pass if the wiring of each wire-pair from end to end is determined to be correct.
3. Length – The field tester shall be capable of measuring length of all pairs of a basic link or channel based on the propagation delay measurement and the average value for NVP. The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the Permanent Link configuration (90 meters – 295 feet) plus 10% to allow for the variation and uncertainty of NVP.
4. Insertion Loss (Attenuation) – Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through 100 MHz in maximum step size of 1 MHz. It is preferred to measure insertion loss at the same frequency intervals as NEXT loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk Ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results of the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which the worst case value occurs, and the test limit value at this frequency.
5. NEXT Loss – Pair-to-pair near end crosstalk loss (abbreviated as NEXT loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1 through 100 MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT loss measurements shall not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

Table 1 – Maximum frequency step size as defined in ANSI/TIA-1152

Frequency Range (MHz)	Maximum Step size (MHz)
1 - 31.25	0.15
31.26 - 100	0.25

6. PS NEXT Loss – Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link under-test (a total of eight results). PS NEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through 100 MHz and the step size may not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Maximum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS next. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
7. ACR-F Loss, pair to pair – Attenuation Crosstalk Ratio Far-end is calculated from the pair-to-pair FEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ACR-F Loss that must be evaluated and reported in the test results. ACR-F measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-F is to be measured 1 through 100 MHz and the maximum step size for FEXT loss measurements shall not exceed the maximum step size defined as the standard as in Table 1. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst value for ACR-F. These wire pairs must be identified for the

tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

8. PS ACR-F Loss – Power Sum Attenuation Crosstalk Ratio Far-end is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs of the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
9. Return Loss – Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured from 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the Category 5e Standard as shown in Table 1. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst value of Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
10. Propagation Delay – Propagation delay is the time required for the signal to travel from one of the links to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the wire pair with the worst propagation delay. The report shall include the propagation delay value measured as well as the test limit value.
11. Delay Skew – [as defined in the Category 5e Standard; Section 6.2.19] This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

C. Test Result Documentation

1. The test results/measurements shall be transferred into a Windows based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test and that these results cannot be modified at a later time.
2. The database for the completed job shall be stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports.
3. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:
  - a. The identification of the link in accordance with the naming convention defined in the overall system documentation.
  - b. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number.
  - c. The date and time the test results were saved in the memory of the tester.
4. General information to be provided in the electronic data base with the test results information for each link:
  - a. The identification of the customer site as specified by the end-user.
  - b. The identification of the link in accordance with the naming convention defined in the overall system documentation.
  - c. The overall Pass/Fail evaluation of the link-under-test
  - d. The name of the test limit selected to execute the stored test results
  - e. The cable type and value of NVP used for length calculations
  - f. The date and time the test results were saved in the memory of the tester
  - g. The brand name, model, and serial number of the tester.
  - h. The identification of the tester interface
  - i. The revision of the tester software and the revision of the test limits database in the tester
  - j. The test results information must contain information on each of the required test parameters that are listed in Section B and as further detailed below under paragraph C5.
5. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. The PC-resident database program must be able to process the stored results to display and print a color graph of the measured parameters. The PC-resident software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.
6. The detailed test results data to be provided in the electronic database must contain the following information:
  - a. Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m330 and test limit value.

- b. Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
- c. Delay Skew: Identify the pair with the largest value for delay skew, the value measured in nanoseconds (ns) and the test limit value.
- d. Insertion Loss (Attenuation): Minimum test results documentation as explained in Section B for the worst pair.
- e. Return Loss: Minimum test results documentation as explained in Section B for the worst pair as measured from each end of the link.
- f. NEXT, ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link.
- g. PS NEXT and PS ACR-F: Minimum test results documentation as explained in Section B for the worst pair combination as measured from each end of the link.

### 3.9 FINAL OBSERVATION & TESTING

- A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final observation and test will be performed by the Owner or Owner's representative no earlier than two weeks after receipt of the written results.
- B. Provide a minimum of one (1) person for observation and testing familiar with aspects of the System to assist the Owner.
- C. The process of testing the System may necessitate moving and adjusting certain components.
- D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.
- E. The following procedures will be performed on each System:
  - 1. Observation of the methods and means employed to incorporate the System within the facility.
  - 2. Verification of proper operation, from controlling devices to controlled devices.
  - 3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each level control, and appropriately record these settings within the Record Documents.
  - 4. Other tests on equipment or systems deemed appropriate.
- F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue their work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the observation and testing period is required, the Contractor shall pay for additional time and expenses of the Owner at the standard rate in effect at that time.

### 3.10 TEST EQUIPMENT

- A. Thirty days prior to start of testing, provide a list to the Owner of test equipment make, model numbers and calibration dates that will be used.
- B. The following equipment shall be available on site for the entire test period through final system testing.
  - 1. Sound Level Meter : ANSI S1.4-1971 Type S1A with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
  - 2. Pink Noise Source - Equal energy per octave bandwidth 20 Hz to 20,000 Hz,  $\pm 1$  dB (long-term average) at 0 dBm output. Stability:  $\pm 2$  dB per day.
  - 3. Dual-trace oscilloscope - 100 MHz bandwidth, 1 mV/cm sensitivity.
  - 4. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 5k Hz. Measurement Range: 1 ohm to 100 kohms.
  - 5. Audio Oscillator: bandwidth 20 Hz to 20k Hz  $\pm 5$  dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level over the range from -30 dBu to +10 dBu.
  - 6. Multimeter - Measurement range, DC to 20k Hz, 100 mV to 300 V, 10 ma to 10 A, dB.
  - 7. NTSC Test generator
  - 8. Real time analyzer with LED or CRT display. The unit shall meet the filter requirements of ANSI S1.11 Class III for one third octave filters.
  - 9. Video (analog) test generator capable of generating signal up to 1920 x 1200 with audio.
  - 10. Video (digital) test generator capable of generating signal up to 1920 x 1200 with audio.
  - 11. Ladders and scaffolding necessary to inspect elevated equipment, junction boxes, etc.

- C. Provide three portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project. Include rechargeable batteries and recharger along with holster for wearing on belt. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

### 3.11 INSTRUCTION OF OWNER PERSONNEL

- A. Provide instruction to Owner designated personnel focusing on the use, operation and maintenance of the systems, scheduled as a minimum of two separate sessions, by an instructor fully knowledgeable and qualified in system operation. The System Reference Manuals should be complete and on site at the time of this instruction. Coordinate schedule of demonstration with Owner's Representative.
  - 1. Black Box
    - a. 2 hours of instruction
- B. Video record all training sessions and compile a training video to be provided to the Owner on DVD.
- C. Provide sign in sheet to document the attendee's presence.
- D. If Contractor is not properly equipped to conduct Owner training on particular equipment, arrange for factory representatives of the equipment to be present to provide training at no additional cost to the Owner.

### 3.12 CLEANUP AND REPAIR

- A. Upon completion of the work, remove refuse and rubbish from and about the premises. Leave areas and equipment clean and in an operational state. Repair any damage caused to the premises by the installation of systems at no cost to the Owner.

END OF SECTION

SECTION 27 41 16.20

LOCAL SOUND REINFORCEMENT SYSTEMS

PART 1 – GENERAL

1.1 RELATED WORK

- A. The following sections shall associate with this specification as applicable.
1. General Conditions
  2. Supplementary Conditions
  3. Division 1
  4. Division 26 in its entirety.
  5. Division 27 in its entirety.
  6. Division 28 in its entirety.

1.2 DESCRIPTION

- A. Summary of Work:
1. Provide all equipment specified well as all miscellaneous parts and materials required for the proper, complete, and functional Video and/or Sound Distribution System at the following Venues:
    - a. Athletic Fields
      - 1) Football Pressbox
  2. All applicable equipment shall bear the UL label.
  3. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.
  4. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the owner.
  5. Plenum rated cable may be used as an option at the contractor's discretion. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
  6. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
1. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer's maximum available product warranty.
  2. All individuals installing the audio-video system must be employees of the authorized dealer and at least 75% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
  3. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be allowed for any portion of the audio-video scope of work.
  4. The System Installer shall meet all applicable regulations of the State and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of ten (10) projects of equivalent size or larger and contact names confirming successful completion of projection system installations.

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5. The bidder shall have an authorized service center, within 75-miles of the project's location, for the brand of equipment that is submitted for bid. The Owner, Architect, and Consultant reserves the right to perform an onsite inspection as they deem necessary.
  6. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.
  7. The bidder shall have a full-time local service personnel capable of servicing the projector system described herein.
- B. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
  2. The contractor shall provide a mockup of the complete integrated audiovisual system solution for each of the typical spaces below before implanting the installation in multiple like rooms. Mockup shall include all products listed in part 2 of this specification. Coordinate with G.C., Architect, Consultant, and Owner for scheduling and location of mockup.
  3. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.
- C. Acceptance: The Owner's representative reserves the right to reject all, or a portion of the work performed, either on technical or aesthetic grounds.
- D. Warranty:
1. The selected system installer shall be factory authorized service center and shall provide an end-to-end performance warranty of not less than one (1) year. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that video projection system projectors have been tested to the district's approval. This end-to-end warranty shall cover the labor associated with removing/reinstalling any associated hardware or equipment as well as the replacement of all defective equipment or hardware.
  2. The bidder shall also submit with the materials mentioned in section 1.5 submittals of this specification a written explanation outlining the terms and conditions of product warranty of all parts and service of the integrated a/v solutions.

#### 1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
  2. National Electrical Code, current version
- B. Other References:
1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
  2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
  3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
  4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
  5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
  6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
  7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
  8. ISO/IEC 1180 Generic Cabling Standard
  9. EN 50173 Generic Cabling Standards for Customer Premises
  10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications

#### LOCAL SOUND REINFORCEMENT SYSTEMS

and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

#### 1.5 ABBREVIATIONS

- A. The following abbreviations are used in this document:
1. AV-\*# Audiovisual input station / Presentation Station (Reference drawing legend) CMP Ceiling Mounted Projector LCD or LED Flat panel screen/monitor

#### 1.6 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
  2. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
  3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
  4. Testing: Proposed Contractor test result forms, and a list of instrumentation to be used for systems testing.
  5. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
  6. The resume and contact information of the full-time service personnel responsible for the installed projection system.
  7. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
  8. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire sooner than 12 months after substantial completion of the project.
    - a. AMX authorized dealer certification
    - b. Installer training certification: 1) Provide specification with line-by-line acknowledgement of compliance.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
  2. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
    - a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
    - b. Location of sleeved wall pass-thru
    - c. Size of sleeve at each location installed
    - d. Quantity of cable passing through each sleeve
    - e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
    - f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
  3. Drawing Compliance: A letter shall be provided stating that the installer complies with the

ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

- C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
  2. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
  3. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction and shall be provided to the Owner for their use on disc or USB drive with the project name and description (2 copies).
  4. Provide schematic line diagram of system components as deployed in each installation.

## PART 2 – PRODUCTS

### 2.1 GENERAL

All products listed in this section shall be provided and installed by the contractor unless otherwise noted below. The following list is not intended to be a complete list of required equipment or cables as the project is to be Turnkey and may require equipment beyond the depth of this list. It is the contractor's responsibility to ensure that they are providing a complete and functional system with their proposal.

- A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect / Engineer to review.
- C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.
- D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:  
CM Communications Cable  
CMP Plenum Rated Communications Cable  
CMR Riser-Rated Communications Cable
- E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
1. Approved Products

- a. Twisted-pair cable: Dyna-Blue
  - b/ American Polywater
- G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
  - 1. Approved Products
    - a. 3M or
    - b. Pre-approved equal

## 2.2 TRAINING

- A. A minimum of eight hours for instruction in proper operation and routine maintenance of the system. Instruction shall cover all materials indicated in the Owner's operations manual.
- B. Operational guidelines shall be given in written form in sufficient numbers so that all key personnel have operational instructions of programming; station use and special features. Copies of these instructions shall be provided for permanent record in the operations and maintenance manuals.

## 2.3 WARRANTY

- A. One year from Date of Substantial Completion

## 2.4 PRODUCTS AND MATERIALS

- A. Athletic Field P.A. System: replace existing systems
  - 1. Amplifier: QSC 4-channel PLD 4.2 or similar product
  - 2. Rack: Middle Atlantic DTRK-718 or similar product
  - 3. Mixer: Art MX622 or similar product
  - 4. Wireless Microphones: Two (2) Shure QLX/ULX wireless mics
  - 5. Exterior mounted speakers- JBL AWC 129 BK
    - a. Mount speakers on front of press box: two speakers on each side, mounted horizontally one over the other. Speakers must be mounted to move left and right horizontally.
  - 6. Wall mounted equipment (in the knee space in center of press box)
    - a. One Mic Jack Plate
    - b. One L-R Aux input plate (2 RCA audio jacks)
- B. Hearing Assist System – Provide hearing assist systems in areas are required by code. The hearing assist system is to consist of a FM transmitter with one antenna. The transmitter will broadcast in the FM band from 72.1 MHZ to 75.9 MHZ.
  - 1. Williams Sound PPA L157 system with PPAR35 receivers, one RPK005 rack mount kit and one ANT005 whip antenna
  - 2. Provide belt packs and mics in quantities required for space capacity as per ADA standards.

## PART 3 – EXECUTION

### 3.1 GENERAL

- A. Contractor is required to properly mount integrated A/V solutions and connect all ceiling video / audio cables to projector component inputs.
- B. Contractor is required to thoroughly test and verify operation of all A/V inputs and video modes prior to project completion.
- C. Contractor is required to focus and adjust projector to properly project image on viewing surface (screen or multimedia board depending on location).
- D. Contractor shall provide owner with written verification test process and results once all projectors

## LOCAL SOUND REINFORCEMENT SYSTEMS

have been installed, tested, and placed in final condition.

- E. Damage: The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
- F. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

### 3.2 DOCUMENTATION

- A. Contractor shall provide owner with detailed serial number listing and associated graphical room number designation equipment was installed. Contractor shall use actual graphical package room numbers not architectural plan numbers from construction set.

### 3.3 STATION WIRING INSTALLATION

- A. General: All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of all category 6 cable. There shall never be more than one and one-quarter inch of unsheathed enhanced Category6 UTP cable at either the wiring USB Transmitter or Receiver.
- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes:
  - 1. All cabling placed in ceiling areas must be in conduit, cable tray or an approved J-Hook cable support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.
  - 2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
  - 3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to ensure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install audio-video cabling.

### 3.4 STATION HARDWARE

- A. Flush mounted components: all components shall be inserted to a flush mounted faceplate unless designated otherwise.
- B. Placement: Where possible, the AV input outlets shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches. The CMP outlet shall route directly to the rear of the projector and does not require any type of faceplates.

#### LOCAL SOUND REINFORCEMENT SYSTEMS

### 3.5 PROGRAMMING

- A. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:
1. AV Control Panel Configuration
  2. Audio routing from any source location through the DSP
  3. Projector and screen control via the Audio / Video Control panel
  4. Device resolution and over/under-scanning settings
  5. Incorporation of any Owner furnished source equipment (maximum of 3)

### 3.6 FINAL TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors. Testing procedures shall consist of, but not be limited to the following:
1. Input locations to be tested utilizing multiple types of source equipment. Equipment to include:
    - a. Personal Computer (laptop)
    - b. Apple iMac
    - c. Apple Mac Mini
    - d. Google Chromebook
    - e. Additional devices may be required at the time of testing
    - f. contractor to provide devices on a single cart, to roll between inputs during testing.
  2. Routing of video, from any source to each projector and display simultaneously and independently.
  3. Routing of audio, from any source to each audio channel simultaneously and independently.
  4. Control of the entire system from each installed A/V Control Panel
  5. Additional test requirements may be required at the Owner and/or Consultant's request.

### 3.7 OWNER TRAINING AND DEMO

- A. A/V integrator shall provide demonstration of all integrated a/v solutions to owner's staff that have any stake with the operation and maintenance of the a/v solutions. Integrator shall produce sign in sheets for record of who was trained and when. Copies of sign in sheets shall be submitted with close out paperwork. Coordinate training dates with owner at project completion.
- B. Integrator shall provide factory training for owner's operations and maintenance personnel for each major component of the systems listed in the A/V solutions outlined in part 2 of these specifications. Training shall be a minimum of 4 hrs. per person. Re-training of staff shall be available, at no cost to the owner, to a maximum of 3 on-site training sessions up to 1 year from the date of project completion.
- C. All training is to be recorded via video recording and a copy of the recorded video shall be provided to the owner upon completion. All video recording equipment, for the recording of training, shall be provided by the integrator.

END OF SECTION



SECTION 27 50 00

SCHOOL COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

- A. Conditions of the Contract
- B. Division 1
- C. Division 26
- D. Division 27
- E. Division 28

1.2 SUMMARY

- A. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, incorporating school safety notifications and general communications including but not limited to the following:
  - 1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
    - a. Two-way internal intercommunications between staff locations and classrooms.
    - b. Scheduled bell events.
    - c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
    - d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
    - e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
    - f. District-wide, Emergency, Group, All School and Zone live voice paging.
    - g. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music, and voice.
    - h. Web-based user interface.
  - 2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
  - 3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
  - 4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.
  - 5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
  - 6. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
  - 7. The platform shall synchronize its system time to the network timeserver or a web-based time server.
  - 8. Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.
  - 9. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
  - 10. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.
  - 11. Any network switches that are required shall be provided by the owner. Contractor is

SCHOOL COMMUNICATION SYSTEM



responsible for coordinating the switch requirements with the owner.

- B. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.
- C. Integrate the communications system with the following systems:
  - 1. Clock and Bell System
  - 2. Local sound reinforcement sound systems
- D. Return air plenum cable shall be used. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
- E. The drawings and specifications are to be considered conceptual in nature and are intended to establish system standards insofar as manufacturer type and system configuration. The contractor shall provide pricing of a complete engineered system based on the issued conceptual documentation. The engineered system is to be submitted to the project's consultant for review prior to installation.
- F. This system is intended to be upgraded utilizing the existing Telecenter U controller, with the addition of gateways, to integrate the existing classroom and corridor speakers. Rewire all existing Lockdown Buttons to Telecenter U.
- G. Replace Master Clock in intercom system headend. Provide new secondary clocks as indicated on drawings. Remove all other secondary clocks, including wiring. Return to owner.
- H. Prior to construction, a system test is required by the contractor, to verify the current state of the system. Any non-functioning item shall be noted and addressed by CFISD maintenance, prior to start of this work. If the system is proven to be 100% functional, the contractor is responsible for any repairs necessary to bring it to its previous state, at no additional cost to the owner.
- I. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.

### 1.3 DEFINITION OF TERMS

- A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

### 1.4 SUBMITTALS

- A. Product data for each component.
- B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer's cuts sheets which are to be used.
  - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
  - 2. Artwork drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
  - 3. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
  - 4. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.

- C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.
- D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.
- E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.
- F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.
- G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.
- H. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.
  - 1. Record of Owners equipment-programming option decisions.
  - 2. All instructions necessary for proper operation and manufacturer's instructions.
  - 3. "Proof of Performance" information.
  - 4. Manufacturer's maintenance information.
  - 5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.
- I. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".
- J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.
  - 1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
  - 2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
  - 3. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
  - 4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.
- K. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:
  - 1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
  - 2. The Installer shall be bondable.
  - 3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:

- a. Adequate plant and equipment to pursue the work properly and expeditiously.
  - b. Adequate staff and technical experience to implement the work.
  - c. Suitable financial status to meet the obligations of the work.
  - d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.
- B. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturer's product for it least seven (7) years, the following is required:
  - 1. A list of two (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds seven (7) years.
  - 2. A letter from the manufacturer outlining the details of changes in service providers over the last seven (7) years and what actions they will take to ensure continuity of service to the customer.
- C. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- E. Comply with NFPA 70
- F. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.
- G. Comply with UL 60950.

#### 1.6 SUBMITTALS

- A. Project Initiation:
  - 1. Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
    - a. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
    - b. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
    - c. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
    - d. The resume and contact information of the full-time service personnel responsible for the installed projection system.
    - e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
    - f. Certifications: The contractor shall submit all of the following certifications, and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
      - 1) State Licenses as applicable to this system
      - 2) Manufacturer's Authorized Dealer Certification
      - 3) Manufacture Installer Training Certificate (required for at least 25% of all

- installers on site.)
- g. Provide specification with line-by-line acknowledgement of compliance.
- B. Shop Drawings:
1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
    - a. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
    - b. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
      - 1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
      - 2) Location of sleeved wall pass-thru
      - 3) Size of sleeve at each location installed
      - 4) Quantity of cable passing through each sleeve
      - 5) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
      - 6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
    - c. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.

#### 1.7 IN-SERVICE TRAINING

- A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.
- B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.
- C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all the staff and faculty members who attended, received, and completed the training program.

#### 1.8 WARRANTY

- A. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call-in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one-year warranty shall be provided for labor.
- B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.
- C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any warranty

service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide "loaner" equipment to the facility at no charge.

- D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

## 1.9 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the following system:
  - 1. Telecenter U as manufactured by Rauland and installed by a Rauland authorized dealer

## PART 2 - PRODUCTS

### 2.1 SYSTEM REQUIREMENTS

- A. The New Campus Communications System will connect to the Existing District Server for District Wide announcements and all Management Functions. Server Currently Runs the Rauland Telecenter Campus Enterprise Software.
- B. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.
- C. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.
- D. The platform shall be a single electronic system consisting of a minimum of 10 audio channels for each campus, (classroom) IP Speaker Modules and call switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.
- E. Each Classroom shall be provided with a Speaker Module interface and a minimum of 5 different call switches, each with their own annunciation path and priority.
- F. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.
- G. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.
- H. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.
- I. Call-in annunciation route shall include playing pre-recorded audio over speakers, sending a pre-configured email, and activating relays.
- J. The platform shall lend itself to expansion by simple addition of hardware modules.
- K. The platform shall connect directly to an existing, standard protocol WAN/LAN network, without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored, and downloaded to the system by an authorized user from a web-based user interface.

- L. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.
- M. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands-free and will not require any interaction by the classroom user.
- N. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during an emergency with a single button press. The front office administrator will receive confirmation that the classroom is safely secured via an administrative console and web-based user interface. The front office administrator can view classrooms that are not safely secured via the administrative console. The front office administrator can view classrooms that are not safely secured via the web-based user interface. The front office administrator shall be able to initiate two-way communication, without a pre-announcement tone, to the classroom during an emergency via the administrative console. Web-based user interface will still identify that a school is in an emergency, even if all classrooms are safely secured. Individual classroom check-in and school emergency status shall be viewed from the web-based user interface, both on-site and remotely.
- O. IP Addressable and POE powered Speaker Modules for individual rooms shall be system programmable and may be assigned any two, three, four, five- or six-digit number as well as name and description. Any extension may be reassigned at any time.
- P. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in a campus. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Preannounce tone and supervisory tones shall be disabled during designated emergencies automatically.
- Q. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored, and assigned to calendar days for the local school by an authorized user from a web-based user interface.
- R. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.
- S. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duplex, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to announce repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in

a district can have its own customized sequences, and can be activated individually, in groups, or districtwide.

## 2.2 EQUIPMENT AND MATERIAL

### A. Server Software

1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
3. The software has the ability to sync system time to the Atomic Clock Signal or to the school's or district's network time server.
4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages, and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g., lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones can be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
7. The software can be installed in cloud, virtual or physical server environments.
8. The web-based user interface supports secure HTTP browsing.
9. The software supports encryption to ensure secure access.
10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.
11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.
12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.
16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools, or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools, or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools, or groups of schools, from

- the web-based user interface.
18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.

B. Campus Controller

1. Provides call routing for paging and intercom for a single facility.
2. System shall connect to the district provided Telephone Network via a SIP connection.
3. Support a flexible numbering plan allowing two, three, four, five, or six-digit extensions.
4. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer internal intercom call-ins, make pages, and change priorities of call-ins in progress.
5. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
6. Ability to upgrade priority level from individual call switch.
7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
8. The ability to automatically escalate incoming call-ins to an alternate telephone or group of telephones if they remain unanswered for a predetermined amount of time.
9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
10. The ability for classrooms to "check-in" via push button when they have successfully secured their location during emergency.
11. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
12. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
13. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
14. Ability for administrative consoles and connected phones to selectively monitor audio at any two-way speaker during an emergency.
15. Stores a minimum of 48 hours' worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
16. System has the ability to sync system time to the Atomic Clock Signal or to the school's or districts network time server.
17. System's SIP Interface shall provide:
  - a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
  - b. Ability to answer a call-in directed to that SIP extension.
  - c. Ability to upgrade a call-in directed to that SIP extension.
  - d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
  - e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
  - f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.
18. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages, and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
19. The system can automatically broadcast emergency instructions throughout an entire



campus when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones can be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

- C. IP Addressable Modules:
1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.
    - a. All Modules are POE 802.3af compliant
    - b. All Modules support DHCP.
    - c. All Modules connect to network with a single RJ45 connector
  2. IP Addressable Speaker Module
    - a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
    - b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
    - c. An option for Privacy call in switches is supported. When the Privacy switch is activated, it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
    - d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
    - e. Intercom and paging volume adjustable from Software interface.
    - f. Rauland TCC2011A with BAFKIT2X2L8RJ speaker or equal for classroomspeakers
  3. IP Addressable Zone Paging Module
    - a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
    - b. Zone Paging Modules shall be rack and wall mountable.
    - c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio, and emergency notification.
  4. IP Addressable Aux I/O Module
    - a. Aux I/O Module shall have two input contacts and two output contacts.
    - b. Input and output contacts are individually addressable.
    - c. Aux I/O Module shall be wall and rack mountable.
    - d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
    - e. Aux I/O Module can perform school lockdown from a single press of a panic button.
  5. IP Addressable Program Line Input Module
    - a. Program Line Input Module shall provide line level audio program distribution into system.
    - b. Program Line Input Module shall have a 3.5mm cable jack.
    - c. Program Line Input Module shall be configured via web-based user interface.
    - d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.
    - e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.
- D. IP Addressable Analog Gateway
1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.

2. Each Gateway will have 5 watts of power per port and 25 watts total per device.
  3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
  4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
  5. Classroom intercom volume adjustable from Software interface.
  6. Classroom paging volume adjustable from Software interface.
  7. Configured to the school network and can be used in conjunction with IP Addressable Modules.
- E. IP Addressable Administrative Console
1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.
  2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
  3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
  4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
  5. Ability to perform intercom to any single IP Addressable Speaker Module.
  6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
  7. Ability to upgrade a call-in via soft key.
  8. Programmable soft key access from any console for activating relays, campus wide.
  9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.
  10. Classrooms that have not 'checked-in' during an emergency are listed on the Administrative Console's screen.
  11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.
- F. Audio Paging/Program Amplifiers – Ashly NE 8250
1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
  2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.
- G. Normal/Emergency Call Switch – Rauland Dual Level Call-In Switch
1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:
    - a. One (1) "Normal" call switch that shall activate a distinctive "NORMAL" level call from single button activation. The button shall be clearly marked "NORMAL" and will route the call-in to any one or more Administrative Consoles and/or Marquee Displays for quick and easy response from an Administrative Console.
    - b. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY" level call from single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.
- H. Emergency/Check-In Call Switch – Rauland Check-In Call-In Switch
1. Emergency/Check-In Call Switched indicated on the drawings shall provide the following functions and features:
    - a. One (1) "Emergency" call switch that shall activate a distinctive "EMERGENCY"

level call from single button activation. The button shall be red in color and shall be clearly marked "EMERGENCY" and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

- b. One (1) "CHECK-IN" call switch that shall activate a distinctive "CHECK-IN" level call from single button activation. The button shall be blue in color and shall be clearly marked "CHECK-IN" and will route the call-in to any one or more Administrative Consoles. This button will be used for emergency check-ins during school emergencies, notifying the front office of the classroom occupants' safety during an emergency.

I. Equipment Racks

- 1. All equipment racks shall provide 44 spaces (77") minimum for mounted system equipment.
- 2. All equipment racks shall be multi-rack format ("gangable") style, bolted together, and open cavity.
- 3. All equipment racks will be provided with lockable rear doors.
- 4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
- 5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
- 6. Rack mounted equipment shall be accessible from front and rear.
- 7. All unused rack spaces will be covered with appropriate blank/vent panels.

J. Interior Ceiling Speakers

- 1. Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8" speaker mounted in a 2 foot by 2 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.
- 2. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT 5e or Cat 6 cable.
- 3. The speaker shall include provisions to allow attachment of a safety cable if required.
- 4. Quam 17URS 2X2 lay-in speaker or equal for offices and hallways.
- 5. Rauland ACC1400 or equal with backcan for bathrooms and hard ceilings

K. Wall Mounted Horns

- 1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.
- 2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4"x10-3/4"x6" deep.
- 3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper-proof, stainless steel mounting hardware. The baffle shall have a mar/scratch baked epoxy rust inhibitive finish.

L. Uninterruptible Power Supplies (UPS)

- 1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
- 2. UPS equipment will be sized in accordance with the system manufacturer's recommendations.
- 3. Provide an individual UPS for EACH remote gateway outside of the MDF (Gateway) furnished with the system.
- 4. Provide additional UPS(s) for protection of all other equipment furnished with the system and housed in the equipment racks.

- 5. All UPS equipment shall be rack mounted.
- M. Wall Mounted Volume Control
  - 1. Provide as shown on floor plans. Provide Atlas AT-10PA or approved equal recessed autotransformer volume control. Routine paging shall not override the volume control.
- N. Wall Mounted Emergency Lockdown Button
  - 1. Provide Safety Technology International Stopper Station Push, Turn-to-Reset w/shield w/sound, or pre-approved equal in locations as shown on floor plans.
  - 2. Labeled "LOCKDOWN"
  - 3. Lockdown shall be Blue
- O. Program Source Equipment
  - 1. RDL D-J3 wall mounted RCA and XLR mic/line input panel, or equal, located at receptionist desk, connected to system headend.
- P. Surge Protector
  - 1. Provide TrippLite IsoBar
- Q. Clock System
  - 1. Master clock power supply and clocks by Sapling.
    - a. Provide 16" clocks at following locations; Cafeteria/commons, Library
    - b. Provide 12" clocks at following locations: Clinic, receptionist desk
- P. Additional Equipment:
  - 1. Contractor shall include in their pricing, the cost to furnish and install the following additional equipment. These devices shall be used to fulfill any changes request issued until the list is depleted. Upon the completion of the project, all remaining material shall be delivered to the project for owner stock. No devices shall be used without documentation and written authorization from the project's technology consultant. Contractor shall obtain a signed transmittal of additional equipment to the owner at the end of the project. The signed transmittal shall be included in the contractor's closeout documents.
  - 2. Additional Equipment List:
    - a. Five (5) Ceiling Mounted Speakers with tile bridges
    - b. Two (2) Wall Mounted Volume Controls
    - c. One (1) Exterior Speakers

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.
- B. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Furnish and install all material, devices, components, and equipment for a complete operational system.
- C. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

- E. All housings are to be located as indicated.
- F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.
- G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
- H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.
- I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.
- J. Provide integration of local sound reinforcement system override.
- K. Provide integration of remote lockdown pushbuttons.
- L. Install new speaker types as indicated on the drawings.
- M. Speakers in high ambient noise areas (cafetorium, gymnasiums, etc.) shall be tapped as required to overcome the ambient noise generated by the public.
- N. Provide silicone sealant to all openings and conduit penetrations at all exterior back box locations.
- O. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.
- P. All exterior wall penetrations shall be properly sealed to prevent moisture from entering the building.
- Q. Conduit and Cables
  - 1. Install conduit, fittings and boxes as specified in Division 26.
  - 2. Single system cables shall be grouped together in a common conduit of adequate capacity to facilitate the ease of installation and prevent conductor or insulation damage.
    - a. In no case shall the conduit fill exceed 40% capacity.
    - b. Do not group conductors or cables of different systems in a common conduit.
    - c. Provide and install protective bushings on all conduit stub outs and sleeves, prior to cable installation, to prevent cable damage.
  - 3. Cable:
    - a. Install cables as recommended by the system manufacturer. Conductor quantities specified are minimum required. Conductors to be installed shall be coordinated with the system equipment supplier.
    - b. Cables installed on exposed surfaces, in inaccessible locations, or underground shall be installed in conduit.
    - c. Cables installed above accessible ceiling spaces may be installed without conduit. All cables not installed in conduit shall be plenum rated.
    - d. Cables shall be routed down corridors, parallel and perpendicular to the building walls and structure. Cable to each device shall branch off a main corridor trunk.
    - e. Routing cables through classrooms, offices, storage rooms, restrooms, or any type of room other than a corridor will not be accepted. Enter rooms above the associated room doorway.
    - f. All cabling shall be home runs to head-end equipment to allow for zoning to be accomplished.
  - 4. Cables not installed in conduit shall be grouped and bundled. Cable shall be bundled on a maximum of 2'-6" on center. Support cables from D-rings or J-hooks. D-rings and J-hooks

shall be secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.

5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible location.
6. Tag each circuit at each end and at each terminal with a separate tag indicating the area served.

R. Emergency Lockdown Buttons

1. Cabling for each Emergency Lockdown Button shall be homerun to the Communication System head-end equipment.
2. Communications system shall communicate with intrusion system over the network when there is a lockdown event.
3. Provide connection from the Communication System head-end equipment to the Intrusion Detection System head-end for sending notifications to the CFISD Police Department. Coordinate additional requirements and programming with Owner.
4. Button shall cause the Intercom System to send a distinct alert tone throughout all speakers in the building. Coordinate exact tone with Owner.
5. Button shall send an Emergency Call signal to all Administrative Call Stations.
6. Communication System shall alert essential personnel via SMS and e-mail that a Lockdown event has occurred at the campus. Coordinate additional requirements with Owner.
7. Buttons and alert tone shall be reset by pressing the All-Clear button on any Administrative Call Station console.
8. Coordinate Emergency Lockdown Button device identification naming with Owner.

S. Volume Controls

1. Volume Controls shall be configured with emergency call override, allowing emergency announcements to be heard regardless of the position of the volume control.

3.3 ADDITIONAL REQUIREMENTS

- A. Provide visual PA indicator light in deaf education areas and wire into the communications system for bell tones.

3.4 GROUNDING

- A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
- B. Racks and cabinets shall be grounded to the metallic structure of the building or to the building system power ground in accordance with NEC section 250. Securely bond equipment to the ground system through a minimum 14-gauge green insulated conductor.
- C. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
- D. Electronic systems shall be grounded to the building system ground, with a maximum resistance of 0.1 ohm. Systems ground shall be a driven ground rod, building steel, or other approved ground of the building power systems ground.
- E. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-

testing, testing, and adjustment of the system.

- B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

### 3.6 FINAL ACCEPTANCE TESTING

- A. The Final Acceptance Testing shall be provided to the Owner, or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.
- B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.
- C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

### 3.7 COMMISSIONING

- A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.
- B. Schedule training with Owner through the Owner's representative, with at least seven days advance notice.

### 3.8 OCCUPANCY ADJUSTMENTS

- A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

### 3.9 CLEANING AND PROTECTION

- A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked, and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION 27 50 00

SECTION 28 01 00

OPERATION AND MAINTENANCE (O&M) MANUALS  
OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.
- D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.
- E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.
- F. The final submitted manual shall include a sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
  - 1. Table of Contents for each element
  - 2. Contractor information
  - 3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant's stamp of acceptance.
  - 4. All parts and maintenance manuals for items of equipment
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates)
  - 9. Control operations / equipment wiring diagrams
  - 10. Coordination Drawings
  - 11. Schedule of Low Voltage Wire and Cable
  - 12. Schedule of ESS Equipment
  - 13. Schedule of ESS Field Devices
  - 14. Access Control Door Schedules
  - 15. Video Surveillance Camera Schedules
  - 16. Other required operating and maintenance information that are complete.
  - 17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.



1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
  2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.
- D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.
- F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

## PART 2 - PRODUCTS

### 2.1 BINDERS

- A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
  2. Minimum ring size: 1"; Maximum ring size: 3".
  3. When multiple binders are used, correlate the data into related groupings.
  4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

## PART 3 - EXECUTION

### 3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals Submitted in Hard Copy Format:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
  2. Format:
    - a. Size: 8-1/2" x 11"
    - b. Text: Manufacturer's printed data or neatly typewritten.
  3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable
    - c. Identity of general subject matter covered in the manual.
  6. Binder as specified
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement
    - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
  2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:

- 1) Identify specific product or part installed.
    - 2) Identify data applicable to installation.
    - 3) Delete references to inapplicable information.
  3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  4. Written text as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  5. Copy of each warranty, bond and service contract issued
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
  1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts:
      - 1) Function, normal operating characteristics, and limiting conditions.
      - 2) Performance curves, engineering data and tests.
      - 3) Complete nomenclature and commercial number of replaceable parts.
    - b. Operating procedures:
      - 1) Start up, break-in, routine / normal operating instructions
      - 2) Regulation, control, stopping, shut down and emergency instructions
      - 3) Special operating instructions
    - c. Maintenance procedures:
      - 1) Routine operations
      - 2) Guide to trouble-shooting
      - 3) Disassembly, repair and reassembly
      - 4) Alignment, adjusting and checking
      - 5) Routine service based on operating hours
    - d. Manufacturer's printed operating and maintenance instructions.
    - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      - 1) Items recommended to be stocked as spare parts.
    - f. Schedule of low voltage wire and cable
    - g. Schedule of ESS equipment
    - h. Schedule of ESS field devices
    - i. Each Contractor's coordination drawings.
      - 1) As installed color coded wiring and cabling diagrams.
    - j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
    - k. Other data as required under pertinent sections of the specifications.
  2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
  4. Provide complete information for products specified in Division 27.
  5. Provide certificates of compliance as specified in each related section.
  6. Provide start up reports as specified in each related section.
  7. Provide signed receipts for spare parts and material.
  8. Provide training report and certificates.

END OF SECTION



SECTION 28 05 00

ELECTRONIC SAFETY AND SECURITY  
BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28 Electronic Safety and Security.
- B. Applicable provisions of this section apply to all sections of Division 28, Electronic Safety and Security.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
  - 1. Division 26 in its entirety.
  - 2. Division 27 in its entirety.
  - 3. Division 28 in its entirety.
- D. The entire drawing and specification package apply to the work specified in the Electronic Safety and Security specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
  - 1. Americans with Disabilities Act (ADA)
  - 2. Authorities Having Jurisdiction (AHJ) - Local
  - 3. American National Standards Institute (ANSI)
  - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
  - 5. Building Industry Consulting Services International (BICSI)
  - 6. Code of Federal Regulations - Title 47
  - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
  - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
  - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
  - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
  - 11. International Electro-technical Commission (IEC)
  - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
  - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
  - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
  - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
  - 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
  - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
  - 18. National Electrical Safety Code (NESC)
  - 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*

20. Society of Cable Telecommunications Engineers (SCTE)
  21. Local Accessibility Standards
  22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
  23. Uniform Building Code (UBC)
  24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*
- B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- D. Obtain all permits required.

### 1.3 SUMMARY

- A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.
- B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.
- C. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

### 1.4 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
  2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
  3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
    - a. Licenses, as applicable to the system being installed
    - b. Manufacturer's Certifications
      - 1) Firm Certification
      - 2) Installer Certification
      - 3) Programmer's Certification
      - 4) System Designer Certification.

### 1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.
- C. Should the drawings or specifications disagree in themselves or with their counterpart, the

better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.

- D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.
- E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.
- H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.
- I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.
- J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

#### 1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless

otherwise noted.

- C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.
- D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.
- E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.7 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3" beyond the finished surface. In pipe chases, they shall extend 8" inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio. 1/2 inch greater than outside diameter of the conduit.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
  - 1. Make final connections to all ESS equipment indicated on the drawings, except as noted.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

#### 1.8 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

#### 1.9 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

#### 1.10 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.
- B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.
- C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
1. Obtained from utility maps and other substantially reliable sources.
  2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

Abbreviations:

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference



ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet ( <i>Now referred to as TR</i> )
TR	Telecommunications Room ( <i>A.K.A. TC - Telecommunication Closet</i> )
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

## 1.16 QUALITY ASSURANCE

### A. Equipment Standards:

1. System and all components shall be brand new stock from manufacturer.
2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

### B. Contractor Qualifications:

At the time of Proposal, the Contractor shall:

1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work.
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

- A. Provide SUBMITTALS according to Division 1 and the following.
- B. Requirements:
  - 1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
  - 2. Submit proof that all system components and cables are U.L. Listed.
  - 3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
  - 4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
  - 5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
  - 6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

#### 1.23 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

#### 1.24 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

#### 1.25 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014+ / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
  - 1. 3 sets of electronic AutoCAD (2014+ dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
  - 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
  - 3. Three sets of blue or black-line prints of each contract as-built drawing.
- C. As-Built Drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's Seal, name, address, and logo from drawings.
  - 3. Mark documents AS-BUILT DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY:
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
  - 6. Indicate exact location of all underground ESS raceways, and elevations.
  - 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
  - 10. Exact location of all ESS equipment in and outside of the building.
  - 11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
  - 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 13. Cloud all changes.

1.26 OPERATING TESTS

- A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.
- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will

be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

## 2.3 STANDARD PRODUCTS

- A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

## 2.4 MANUFACTURE'S INSTRUCTIONS

- A. The Contractor is responsible for furnishing the proper Electronic Safety and Security equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

## 2.5 RUST PREVENTION

- A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

## 2.6 STORAGE AT SITE

- A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.
- B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.
- C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

## 2.7 CONDITION OF MATERIALS

- A. All materials required for the installation of the Electronic Safety and Security systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

## 2.8 NAMEPLATES

- A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

## 2.9 ACCESS DOORS

- A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
1. Plaster Surfaces: Milcor Style K.
  2. Ceramic Tile Surfaces: Milcor Style M.
  3. Drywall Surfaces: Milcor Style DW.
  4. Install panels only in locations approved by the Architect.

## 2.10 SPACE LIMITATIONS

- A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.
- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.
- E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.
- J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and

provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

- K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation is applicable, the more stringent shall apply.
- L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.
- M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- N. The installation shall be performed in a professional manner.
- O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.
- P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.
- R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

### 3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

### 3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

### 3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any

point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

### 3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.
- C. All panels shall be provided with permanently attached engraved lamaroid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. Identification of Equipment:
  - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
  - 2. A black-white-black 3-layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
    - a. Identifying nameplates shall have 1/2-inch high, engraved letters.
  - 3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
  - 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
- E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location.



Comply with industry standards for color and design.

- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

### 3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

### 3.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.
- B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
  - 1. Provide the training during regular working day.
  - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
- C. Time to be allocated for instructions.
  - 1. Minimum of 12 hours dedicated instructor time
  - 2. 4 hours on each of 3 days
  - 3. Additional instruction time for specific systems as specified in other Sections.
- D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
  - 1. One copy to the Owner
  - 2. One copy to the Architect / Engineer
- D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the

demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.8 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

### 3.9 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.10 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

### 3.11 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

### 3.12 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
  - 1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
  - 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

### 3.13 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

### 3.14 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be

conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.

- B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.
- C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.
- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

### 3.15 EXISTING SYSTEM TESTING

- A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 28 umbrellas, as identified in the Division 2 of the Construction Specifications Institute (CSI) current Master Format7 Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.
- B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.
- C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.
- D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

### 3.16 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
  - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
  - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

### 3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.
- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

### 3.18 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
  - 1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
  - 2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
  - 3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
- C. Testing:
  - 1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
  - 2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
  - 3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
  - 1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
  - 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
  - 1. System Operations and Maintenance Manuals
  - 2. System Test Reports
  - 3. As-Built Drawings

3.19 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 28 05 07

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- D. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
  - 1. Actual ESS equipment and components to be furnished.
  - 2. NEC working space and NEC access to NEC working space.
  - 3. Relationship to other equipment and components and openings, doors and obstructions
  - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of ESS station devices and other work specified in this Division.
  - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
  - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
  - 2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and telephone number
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
  - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items requiring correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a resubmittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions,

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA



field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
  - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 01.

### PART 2 - PRODUCTS - NOT USED.

### PART 3 - EXECUTION

#### 3.1 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit individually bound shop drawings and product data for the following when specified or provided:
  - 1. Low Voltage Wire
  - 2. Electronic Access Control and Intrusion Detection
  - 3. Electronic Surveillance
  - 4. Fire Detection and Alarm

#### 3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION

### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

SECTION 28 05 10

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

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

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

CONTRACT QUALITY CONTROL

- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
  - 1. Rough-in
  - 2. Finish with all appurtenances in place
  - 3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

- A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 28 05 50

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson.
- B. 3M (Minnesota Mining Manufacturing).
- C. Hilti
- D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION



SECTION 28 10 00

ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
1. Conditions of the Contract
  2. Division 1
  3. Division 26
  4. Division 27
  5. Division 28

1.2 WORK INCLUDED

- A. Reference Attachment 'A' of this specification for supplemental scope and product material list as it relates to the project and the Owner standards.
- B. ACS devices indicated are for reference and coordination purposes only. The System Installer shall design and provide a complete system, meeting the requirement of specification. Installer shall provide all system devices required to established controlled access and monitoring at locations designated in the contract documents. The system installation shall be in compliance with all governing authorities and the Architect, Engineer, and Owner expectations.
- C. Security system devices indicated are for reference and coordination purposes only. The System Installer shall design and provide a complete system, meeting the requirement of specification. The installer shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.
- D. The system shall include security for all access into building, including but not limited to the following:
1. Control Panels
  2. Power Supplies
  3. Interconnection of panels
  4. Installation of new devices
  5. Card reader
  6. Magnetic locking hardware
  7. Request to exit devices
  8. Door position sensors
  9. Door Hardware (as specified herein and/or in Division 08, door hardware)
  10. Lockdown and Lockout Buttons
  11. Audio / Video Intercom Systems
  12. All additional material, hardware, and labor required for a fully functional, turnkey system
- E. The System Installer shall connect each controller to the ACS Management System.
- F. All system programming will be performed by the system installer. The system installer will be required to meet with the Owner, engineer, and system manager to discuss wiring and termination of the system control panels and field devices prior to installation.
- G. Licensing: The System Installer shall NOT utilize any of the owner's existing licensing for this scope of work. All licensing shall be provided by the System Installer, no exceptions. Including, but not limited to the following:
1. Portal Licensing
  2. Controller Licensing
  3. Wireless Licensing
  4. Video Management Software Integration Licensing
- H. System Installer to refer to Division 08 Door Hardware Specification. Provide and install all

ACCESS CONTROL SYSTEM (ACS)

hardware specified to be provided by the "Access Control Contractor", "Security Installer", "Division 28", or any variation thereof.

- I. System Installer to provide and install door hardware as specified in Specification Section 28 10 00.10 Access Control Hardware Devices - and 28 10 00.05 Access Control Hardware Devices
- J. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.
- K. Remove all existing edge controllers. Provide new cabling and connections to existing and new doors, from centralized controllers. Controllers and card readers that are removed shall be returned to owner.

### 1.3 REFERENCES

- A. Code of Federal Regulations (CFR).
- B. Institute of Electrical and Electronics Engineers (IEEE):
  - 1. 802.3 Ethernet Standards.
  - 2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.
- C. International Electrotechnical Commission (IEC).
- D. International Organization for Standardization (ISO):
  - 1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
  - 2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
  - 3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).
- E. Federal Communications Commission (FCC):
  - 1. FCC Part 15 – Radio Frequency Device
- F. Underwriters Laboratories (UL):
  - 1. UL294 – Access Control Systems Units
- G. Electronic Industries Alliance (EIA)
  - 1. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems
- H. Federal Information Processing Standards (FIPS)
  - 1. Advanced Encryption Standard (AES) (FIPS197)
  - 2. FIPS201-2: Open Options DNA Fusion FIPS in conjunction with an E2-SSP-D2-FIPS, NSC-100-FIPS, RSC-2-FIPS and other listed components will provide an access control solution that is fully FIPS 201-2 compliant.
  - 3. Personal Identity Verification (PIV) of Federal Employees and Contractors
- I. Homeland Security Presidential Directive 12 (HSPD12)
- J. National Fire Protection Association Standards:
  - 1. NFPA 70 - National Electrical Code
  - 2. NFPA 72 - National Fire Alarm Code
  - 3. NFPA 101 - Life Safety Code
- K. RoHS compliant

- L. SIA AC-01-1996.10 - Access Control - Wiegand
- M. Local & State Building Codes
- N. Requirements of Local Authorities having Jurisdiction
- O. Requirements of American Disabilities Act (Public law 101-336).
- P. Texas Accessibility Standards (TAS)
- Q. Texas Insurance Code.

#### 1.4 QUALITY ASSURANCE

- A. System Installer Qualifications:
  - 1. The System Installer shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The System Installer shall have represented the security alarm manufacturer's product for at least two years.
  - 2. The System Installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
  - 3. The System Installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
  - 4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
  - 5. The System Installer must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.
  - 6. The proposing System Installer for this system and the installer of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing System Installer will be allowed.
  - 7. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
  - 8. For proper, smooth, and complete integration of the IP security camera, access control, and intrusion detection systems; the proposing/installing contractor of the video surveillance and intrusion detection systems must be the same contractors.
  - 9. The System Installer must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
  - 10. The System Installer must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the System Installer for performing any work on the project.

#### 1.5 SUBMITTALS AND CLOSE-OUT

- A. Product Data: Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
  - 1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
  - 2. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.



3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
  4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
  5. Certifications: The System Installer shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
    - a. Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
    - b. Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
    - c. Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
  2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
    - a. Location of all control equipment and remote power sources
    - b. Locations of all field devices and outlets
    - c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
    - d. Location of sleeved wall and/or floor pass-thru
    - e. Size of sleeve at each location installed
    - f. Quantity of cable passing through each sleeve
    - g. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
  3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.
- C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:
1. Inspection and Test Reports: During the course of the Project, the System Installer shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The System Installer shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The System Installer shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
  2. Provide complete test reports for all cabling and devices that comprise system as outlined

- in this document.
3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
  4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
  5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
  6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
  7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
  8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
  9. A copy of the manufacturer's warranty on the installed system.
  10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
  11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
  12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
  13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. The System Installer shall provide one complete floor plan sheet at each panel location.

## 1.6 DEFINITIONS

### A. Abbreviations:

- |     |     |                                 |
|-----|-----|---------------------------------|
| 1.  | ACS | Access Control System           |
| 2.  | VMS | Video Management System         |
| 3.  | NVR | Network Video Recorder          |
| 4.  | IDS | Intrusion Detection System      |
| 5.  | GUI | Graphical User Interface        |
| 6.  | IP  | Internet Protocol               |
| 7.  | CR  | Card Reader                     |
| 8.  | DS  | Door Station                    |
| 9.  | MS  | Master Station                  |
| 10. | PIR | Passive Infrared Sensor         |
| 11. | LD  | Lockdown                        |
| 13. | LO  | Lockout                         |
| 14. | MDF | Main Distribution Frame         |
| 15. | IDF | Intermediate Distribution Frame |

### B. Definitions:

1. Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, Wiegand-effect, proximity (active/passive), barium ferrite, smart/intelligent cards, and NFC enabled applications on mobile devices.
2. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secured areas.
3. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through and the times they are permitted.
4. Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using

## ACCESS CONTROL SYSTEM (ACS)

- the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.
5. Alarm: A signal that indicates a problem.
  6. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
  7. Badge: Badge is a template or a design for creating a card. DNA Fusion includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
  8. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
  9. Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).
  10. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
  11. Controller: A microprocessor-based circuit board that manages access to a secured area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
  12. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
  13. Digital Video Recorder: A security system device that records the video from the surveillance cameras (IP and Analog) on a hard disk.
  14. Door: A generic term for a securable entry way. In many access control applications, a "door" may be a gate, turnstile, elevator door, or similar device.
  15. Duress: Forcing a person to provide access to a secure area against that person's wishes.
  16. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller.
  17. Integrated lockset: An integrated, intelligent locking solution that typically runs on batteries, but can be externally powered, that contains most of the door components, i.e. reader, door contact, and request to exit in a single, mountable unit.
  18. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer keyboard.
  19. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically, the state change prompts an action outside of the controller such as activating or deactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
  20. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
  21. Time Schedules: Schedules that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
  22. Video Management System: An enterprise-class video management and storage solution

#### 1.7 PRE-INSTALLATION MEETINGS

- A. No less than a minimum of two weeks prior to rough-in or installation of any access control device, the ACS Installer will be required to attend a pre-construction meeting with the Door Hardware provider / installer to aid in coordination and help avoid gap / overlap during the installation phase.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

### ACCESS CONTROL SYSTEM (ACS)

- B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

- A. The ACS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 - PRODUCTS

- 2.1 Reference Attachment 'A' of this specification for supplemental scope and product material list as it relates to the project and the Owner standards

2.2 MANUFACTURERS

- A. Approved Manufacturers:
1. AMAG Technology Inc.  
20701 Manhattan Place  
Torrance, Ca 90501  
(310).518.2380  
<http://www.amag.com>
- B. Requests for substitutions will be considered in accordance with provisions of Division 1. In the absence of direction by Division 1, substitution request must be submitted no less than ten (1) business days from the time of proposal. Any substitution proposed will have to be proposed as a complete system replacement across the Owner's entire platform, including any cabling and/or hardware changes required to convert all of the Owner's existing sites.

2.3 SERVERS AND USER INTERFACE

- A. Servers and Unser Interfaces are existing to remain. The system installer shall coordinate the installation of all new equipment and/or existing equipment that is affected by the project's scope. All equipment shall be modified and/or added in compliance with the existing systems parameters. The system installed shall provide and additional equipment to furnish a complete expansion of the system as shown on the project drawings, access control schedule, details, and legends.

2.4 ACCESS CONTROL SYSTEM (ACS)

- A. General: The ACS is a modular and networked based system providing physical access control security to a Wide Area campus enterprise. The system shall be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACS shall include, but is not be limited to, the following:
1. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.

- a. The ACS to permit multiple instances of client software applications to run simultaneously on the network. The base system shall include one (1) software application licenses per site with an unlimited number of licenses available subject to connection fees.
2. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
  - a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
3. Encryption: The system to support encrypted communication between the central server software and client software applications (server-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
  - a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
  - b. The ACS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
4. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
  - a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.
5. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
6. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
7. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database, and import / export of employee data.
8. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
9. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
10. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
11. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
12. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
13. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
14. Hardware Interface: The system to integrate with and control specified electrified

#### ACCESS CONTROL SYSTEM (ACS)

- hardware, signaling and monitoring devices.
15. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
  16. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.
- B. Open Protocol: The ACS manufacturer to provide non-proprietary, open protocol hardware for the system control processors and associated device sub-controllers. Systems utilizing a single manufacturer solution that encompasses combined proprietary software and integrated electronic hardware combinations are not acceptable. In addition, integrated electronic locking hardware requiring a processor or sub-controller module upgrade, or extensive access control firmware upgrades to accommodate integrating with an alternate software package, will not be considered.
- C. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be designed to support all of the following:
1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
  2. Direct-connected RS-232 and RS-485 communication cabling.
  3. Dial-up modem connection using a standard dial-up telephone line.
- D. Provide local communication port at each panel for local configuration of system with laptop.
- E. Locate all main control panels in MDF and IDF rooms of each building.
- F. Provide 120v at all controller and power supply locations.
- G. Provide and transfer all required licensing to the owner.
- H. Provide local communication port at each panel for local configuration of system with laptop.
- I. Integrated Elevator Destination Dispatch Control Solutions
1. The ACS shall provide means of integration with the following elevator systems destination dispatch control solution. Integration shall be by software or input/output connection (software, if available between the specified ASC and Elevator System):
    - a. Otis
    - b. Krone
    - c. Thyssen-Krupp
  2. The destination dispatch control solution shall provide the following functions:
    - a. Provide card reader security within the elevator(s) as required.
    - b. Provide card reader security at the Destination Dispatch kiosk(s), as required.
    - c. Allow Default Floor call registration upon card swipe.
    - d. Allow for card flags such as VIP and ADA from a card swipe
    - e. Enforce elevator access levels
- 2.5 ACCESS CONTROL PANEL HARDWARE
- A. Reference Attachment 'A'
- B. System Back-Up Battery: The System Installer shall provide backup batteries as required to furnish ninety (90) minutes of run time to the complete system, including but not limited to lock power and system power.
- 2.6 FIELD DEVICES
- A. General: Coordinate with door hardware and access control schedule as to whether each access control portal is wireless or directly connected to a control panel. Provide all Controllers, Sub-

Controllers, and licensing as required to connect all card reader locations shown on plan.

- B. Card Readers: Provide card readers as shown on the floor plans, access control schedule, and access control details.
- C. Credentials: Coordinate Facility Code, External Start Number, and Internal Start number with the Owner prior to procuring credentials.
- D. Miscellaneous Devices: Provide the following devices as designated per the project floor plans, access control schedules, and access control details:
  - 1. DP/DT Door Position Sensors (Door Contacts)
  - 2. PIR Motion Request to Exit Sensor
  - 3. Lockdown Buttons
  - 4. Door Release Buttons
  - 5. Video Intercom Door Stations (Provide and Install per drawings and Division 28 Audio / Video Intercom specification)
  - 6. Video Intercom Master Stations (Provide and Install per drawings and Division 28 Audio / Video Intercom specification)

## 2.7 WIRING

- A. All cable associated with the ACS shall be purple in color.
- B. Ethernet cabling to access control panels shall be as specified in the Structured Cabling System (SCS) specifications and shall be provided by the SCS Installer. In the event that there is not SCS installer on the project, cabling shall be provided and installed by the ACS Installer and shall comply with the Division 27 SCS specification, minimum of Category 6A cable shall be utilized if not specified otherwise.
- C. Provide cabling and connections for all access control doors in this scope, existing and new. Conventional access control cable shall be a jacketed composite cable. The minimum conductor requirement shall be as follows:
  - 1. Standard
    - a. Lock Power: 4-conductor, 18AWG, shielded
    - b. Card Reader: 6-conductor, 22AWG, OA shielded
    - c. Door Contact: 2-conductor, 22AWG, shielded
    - d. Request to Exit/Spare: 4-conductor, 22AWG, shielded
  - 2. Extended Distance
    - a. Lock Power: 4-conductor, 16AWG, shielded
    - b. Card Reader: 6-conductor, 18AWG, OA shielded
    - c. Door Contact: 2-conductor, 18AWG, shielded
    - d. Request to Exit/Spare: 4-conductor, 18AWG, shielded
- D. Wire scheme and conductor quantity shall be as required by the manufacture's specifications. The System Installer to provide and install shielded cable as required.
- E. All 120v Power shall be furnished by the Division 26 contractor. In the event that a division 26 contractor is not contracted for the project, the system installer shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.
- F. All Security Conduit as required for a complete installation of this system shall be furnished by the division 26 contractor as part of their scope of work. In the event that a division 26 contractor is not contracted for the project, the system installer shall provide and install all conduit required.
- G. Coordination with the Division 26 contractor is the responsibility of the ACS Installer to ensure all conduit is in place for a complete installation.
- H. All systems shall be connected to a dedicated circuit and on an emergency power source if available.

## PART 3 - EXECUTION

### ACCESS CONTROL SYSTEM (ACS)

### 3.1 INSTALLATION

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so, approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- H. Network Connection Cable: Provide a 4 pair Category 6A data cable from the Master Control Panel to the MDF network rack. Category 6A cable shall be purple in color.
- I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
- J. System Installer is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

### 3.2 CABLE PATHWAYS

- A. Cable Support:
  - 1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
    - a. Approved Cable Support Product:
      - 1) Panduit
      - 2) Arlington
      - 3) Caddy
      - 4) Support system shall be sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.
  - 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the system installer shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the cable support hook to the treaded rod.
  - 3. The cable support shall be installed at a maximum of 5' on center.
  - 4. All cable installed shall be attached to the cable support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.



5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
  6. It is the responsibility of the system installer to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
- B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
  2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
  3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
  4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
  5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

### 3.3 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner and the project's Technology Consultant and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

### 3.4 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

### 3.5 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

ATTACHMENT 'A'

PROJECT SPECIFIC SCOPE OF WORK AND EQUIPMENT LIST

PART 1 – PROJECT SCOPE

1.1 DESCRIPTION OF WORK

- A. This project is an expansion of an existing access control system and consists of the provision and installation of a complete and functional Access Control System (ACS) as required to furnish controlled access and access detection to all controlled portals identified on the project drawings. This project is an elementary school renovation for the Cypress-Fairbanks Independent School District.
- B. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the ACS installer, unless specifically stated otherwise.

PART 2 – EQUIPMENT LIST

- 2.1 The ACS installer shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Security Consultant.

2.2 VESTIBULE ACCESS CONTROL PANEL

- A. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate located in the nearest IDF to the main entry vestibule.
- B. One (1) Intelligent Door Controller and door SubControllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum of eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.
- C. An Altronix eFlow 10XNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.
- D. Panel must have a provided emergency power circuit to the R2B2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.
- E. Two Category 6A network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.
- F. Panel IP network configuration information shall be provided by the owner.
- G. All vestibule doors are to be wired back to this main panel with approved composite access control cable and terminated in the following order
  1. Front Entry Door- Reader 1 -24VDC/12VDC output 1
  2. Reception Entry Door- Reader 2 -24VDC/12VDC output 2
  3. Vestibule Exit Door- Reader 3 -24VDC/12VDC output 3
  4. Reception Exit Door- Reader 4 -24VDC/12VDC output 4
- H. Final software configuration / programming of system integration will require owner and system installer consultation.
- I. Vestibule Access Control Panel shall not be limited to provide access control power and controllers to the vestibule only, but shall be available for other controlled doors in the area of influence of that IDF.

2.3 PERIMETER AND INTERIOR DOOR CONTROL PANELS

- A. Door Control Panels are to be installed as needed in MDF/IDF rooms throughout the campus, to provide communications and power for access control devices in the area of influence of each IDF.
- B. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate. Panel must have a provided emergency power circuit to the RB2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.

ACCESS CONTROL SYSTEM (ACS)

- C. One (1) Intelligent Door Controller and door SubControllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.
- D. An Altronix eFlow 10xNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.
- E. Two Category 6 network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.
- F. Panel IP network configuration information shall be provided by the owner.
- G. Final software configuration / programming of the system integration will require owner / contractor consultation.

## 2.4 VEHICLE ACCESS GATES

- A. Access Controlled gates shall be connected to an IP-based 2-Door controller which may be installed near the building perimeter wall, closest to the gate, to provide additional cabling distance.
- B. 2N IP Verso Video Intercom (w/ Wiegand and Prox Reader module) to be installed on pedestal housing for access control entry through controlled vehicle gate.
- C. All gates must have a Tagmaster XT-1 RFID reader installed as the secondary for utilization of district vehicle tag system.
- D. Consultation is required with the owner to determine is additional Vehicle Tags will be required at the time of installation and the amounts needed.

## 2.5 FIELD DEVICES

- A. Card Access Equipment
  - 1. All Card Readers locations to be installed on walls or pedestrian gates shall be PR10 card readers as manufactured Schlage.
  - 2. All Card Readers locations to be installed on doors shall be Harmony series readers as manufactured by Sargent.
  - 3. Access Control contractor shall provide ALL electronic components required for a complete and functioning access control system, to include card reader, door contact, lock power supply, electrified locking device with integrated request to exit, power transfer hinge and wiring harnesses. The door hardware contractor shall be responsible for non-electrified, mechanical door hardware.
  - 4. Access Control contractor shall provide all cabling required for connection to any device incorporated and not incorporated in door hardware.
  - 5. Contractor shall provide 300 HID proximity cards 1386 Series for this campus. CFISD has a Corporate 1000 account set up with HID. The contractor shall purchase cards through HID using this account to ensure card numbers and facility numbers are followed.
  - 6. Provide Ethernet Network Interface to connect school to district-wide access control system. Connect to local area network at each facility.
  - 7. Contractor shall provide all cabling and accessories required to provide complete access control solution and proper integration with building intrusion alarm system for door contact shunting.
  - 8. Provide all door controllers as required to connect all perimeter card reader locations shown on plan plus one additional of each type for attic stock.

## 2.6 WIRING

- A. Access Control Contractor shall provide and install Access Control system cabling.
  - 1. Color code of all security intrusion detection system an access control wiring shall be purple in color.  
Approved products: Lake Composite Access Control Cable: S800081709-07
  - 2. Reference Specification Section 27 10 00 Technical Cabling and Section 28 16 00 Intrusion Detection for cable types.

3. All systems shall be connected to an emergency power source as available.
4. All 120v Power and system conduits as shown on the drawings shall be furnished by a licensed electrical contractor as part of their scope of work.
5. Coordination with the electrical contractor is the responsibility of the Security contractor to ensure all conduit is in place for a complete installation.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. All wiring shall be in accordance with the national Electrical Code, Local Codes and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provides such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.
- H. Network Connection Cable: Provide a Category 6 data cable from the Master Control Panel/Node to the MDF network rack. Category 6 cable shall be purple in color.
- I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated Velcro ties and J-Hooks. (Ref. 28-13-00 3.3A)
- J. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

#### 3.2 CABLE PATHWAYS

- A. Cable Support:
  1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including but not limited to service loops.
    - a. Approved Cable Support Product:  
PANDUIT ® Corporate J-MOD TM modular support system (sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size).
  2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD TM support hook to the threaded rod.
  3. J-MOD TM cable support shall be installed at a maximum of 5' on center.
  4. All cable installed shall be attached to the J-MOD TM support system with plenum rated

#### ACCESS CONTROL SYSTEM (ACS)

Velcro and a plenum rated Velcro tie shall be installed between each J-MOD TM cable support to keep wires neatly bundled throughout the entire run. Tiewraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.

5. ABSOLUTELY NO CABLE, NOT INSTALLED IN CONDUIT, WILL BE ALLOWED TO BE ATTACHED DIRECTLY TO THE BUILDING'S STEEL OR SUPPORTED IN ANY OTHER METHOD THAN THAT STATED ABOVE.
6. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES ON THE PROJECT TO ENSURE THAT THE PATHWAY OF THIS SYSTEM DOES NOT INTERFERE WITH THE INSTALLATION OF THE OTHER TRADES AND TO PREVENT THE INSTALLED PRODUCT OF OTHER TRADES FROM PUTTING STRAIN ON THE INSTALLED WIRING.

B. Conduit / Raceway

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per the NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. BUSHINGS MUST BE INSTALLED PRIOR TO INSTALLING CABLE. CUTTING BUSHING TO INSTALL AROUND INSTALLED CABLES WILL NOT BE ACCEPTED.

3.3 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor, Door Hardware Installer, and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of the system, for the Owner's designated personnel.

3.4 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.
- B. Installed main system devices must be awarded the same warranty provided to the installer by the Manufacturer of the product.

3.5 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

END OF SECTION

SECTION 28 10 00.05

DOOR INTERCOM SYSTEM

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
  - 1. Conditions of the Contract
  - 2. Division 1
  - 3. Division 26
  - 4. Division 27
  - 5. Division 28

1.2 SYSTEM DESCRIPTION

- A. General Requirements:
  - 1. The specified unit shall be of manufacturer's official product line, designed for commercial and/or industrial 24/7/365 use.
  - 2. The specified unit shall be based upon standard components and proven technology using open and published protocols.
- B. Sustainability
  - 1. The specified unit shall be manufactured in accordance with ISO 14001.
  - 2. The specified unit shall be compliant with the EU directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).
  - 3. The specified unit shall be compliant with the EU regulation 1907/2006 (REACH).

1.3 CERTIFICATIONS AND STANDARDS

- A. General abbreviations and acronyms
  - 1. AES: Advanced Encryption Standard
  - 2. API: Application Programming Interface
  - 3. Bit Rate: The number of bits/time unit sent over a network
  - 4. DHCP: Dynamic Host Configuration Protocol
  - 5. DNS: Domain Name System
  - 6. FPS: Frames per Second
  - 7. FTP: File Transfer Protocol
  - 8. H.264 (Video Compression Format)
  - 9. IEEE 802.1x: Authentication framework for network devices
  - 10. IP: Internet Protocol
  - 11. IR light: Infrared light
  - 12. ISO: International Standards Organization
  - 13. JPEG: Joint Photographic Experts Group (image format)
  - 14. LAN: Local Area Network
  - 15. LED: Light Emitting Diode
  - 16. MPEG: Moving Picture Experts Group
  - 17. Multicast: Communication between a single sender and multiple receivers on a network
  - 18. NTP: Network Time Protocol
  - 19. ONVIF: Global standard for the interface of IP-based physical security products
  - 20. PACS: Physical Access Control System
  - 21. PoE: Power over Ethernet (IEEE 802.3af/at) standard for providing power over network cable
  - 22. Progressive scan: An image scanning technology which scans the entire picture
  - 23. QoS: Quality of Service
  - 24. RPC: Remote Procedure Call
  - 25. SIP: Session Initiation Protocol
  - 26. SMTP: Simple Mail Transfer Protocol
  - 27. SNMP: Simple Network Management Protocol

DOOR INTERCOM SYSTEM

- 28. SSL: Secure Sockets Layer
- 29. TCP: Transmission Control Protocol
- 30. TLS: Transport Layer Security
- 31. Unicast: Communication between a single sender and single receiver on a network
- 32. UPS: Uninterruptible Power Supply
- 33. VBR: Variable Bit Rate
- 34. VMS: Video Management System
- 35. WDR: Wide dynamic range

B. The specified unit shall carry the following EMC approvals:

- 1. EN55032: 2012
- 2. EN55024: 2010
- 3. 2014/35/EU
- 4. 2014/30/EU
- 5. 2012/19/EU
- 6. 2011/65/EU
- 7. EN 55032 Class A
- 8. EN 55032 Class B
- 9. EN 55024
- 10. FCC Part 15 - Subpart B Class A
- 11. FCC Part 15 - Subpart B Class B
- 12. FCC Part 15 - Subpart B Class A + B
- 13. ICES-003 Class A
- 14. ICES-003 Class B

C. The specified unit shall meet the following product safety standards:

- 1. IEC/EN/UL 60950-1

D. The specified unit shall meet the following standards

- 1. Audio:
  - a. G.711
  - b. G.729
  - c. G.722 (wideband)
  - d. L16 / 16kHz (wideband)
- 2. Video:
  - a. H.263+
  - b. H.263
  - c. H.264 (MPEG-4 AVC)
  - d. MPEG-4 Part 2
  - e. MJPEG
- 3. Networking:
  - a. IEEE 802.3af/802.3at (Power over Ethernet) [applies to products with PoE]
  - b. IEEE 802.1X (Authentication)
  - c. IPv4 (RFC 791)
  - d. QoS
- 4. Mechanical Environment:
  - a. IEC/EN 60529 IP54
  - b. IEC/EN 62262 IK08

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:

- 1. The system installer shall be the authorized representative of the manufacturer to sell, install, and service the proposed manufacturer's equipment. The system installer shall have represented the security alarm manufacturer's product for a minimum of five (5) years' with experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
- 2. The system installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security

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alarm systems.

3. The system installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security systems for at least ten (10) years.
5. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
6. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Access Control, Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
7. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
8. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
9. The system installer shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
10. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
11. Contractor must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor for performing any work on the project.

B. System Qualifications:

1. The specified unit shall be manufactured in accordance with ISO9001.

1.5 SUBMITTALS AND CLOSE-OUT

A. Product Data:

1. Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
  - a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
  - b. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
  - c. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
  - d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
  - e. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
    - 1) Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized

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dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.

- 2) Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
- 3) Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
  - a. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
  - b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
    - 1) Location of all control equipment and remote power sources
    - 2) Locations of all field devices and outlets
    - 3) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
    - 4) Location of sleeved wall and/or floor pass-thru
    - 5) Size of sleeve at each location installed
    - 6) Quantity of cable passing through each sleeve
    - 7) Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
  - c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.

C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:

1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfil this requirement.
6. An up-to-date record ("as-built") set of approved shop drawing prints that have been

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revised to show each and every change made to the system from the original approved shop drawings.

7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
9. A copy of the manufacturer's warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labelled with the project name and description. (4 copies)
12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. Contractor shall provide one complete floor plan sheet at each panel location.

#### 1.6 WARRANTY

- A. All security system components and labor furnished by the contractor including wiring, software, hardware and custom parts shall be fully warranted for parts, materials, labor and travel expenses for a minimum of three (3) years start from the date of substantial completion.
- B. The manufacturer shall provide warranty and optional extended warranty for the unit for a total period of maximum five years. If enacted as part of the contract, the contractor will repair or replace parts and/or labor per the warranty for the length of this warranty at no cost to the client.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Intercoms shall be IP-based and comply with established network and video standards.
- B. Intercoms shall be powered by the switch utilizing the network cable.
- C. Intercoms shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.

#### 2.2 INTERCOM SCHEDULE

- A. Intercom types listed below describing various resolutions, form-factor and features shall be supplied by a single intercom manufacturer.
- B. The intercom manufacture and model numbers will be as follows:
  1. Modular IP intercom shall be 2N IP Verso with camera. Part # 02907-001
  2. IP intercom base station shall be 2N Indoor View. Part # 02088-001
    - a. 2N Base station stand required. Part # 02039-001
  3. 2N Combo Reader Module. Part # 016939-001
  4. 2N Secure Door Set Tamper. Part # 01975-001
  5. 2N Weigand Module. Part # 01259-001
  6. 2N Surface frame plate. Part # 01289-001
  7. 2N Surface back plate. Part # 01294-001

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## 2.3 INTERCOM

### A. Modular IP intercom

1. The intercom shall meet or exceed the following design specifications:
  - a. Intercom shall include a built-in web server.
  - b. Intercom shall be able to perform defined local access control functionality without being connected to the network.
  - c. Intercom shall be of modular design, include a replaceable front-end frame, providing 1 or 2 additional slots for functional modules, and should support multiple frames stacked side by side. The intercom shall support at least 29 functional modules when fully expanded.
  - d. Intercoms' main unit shall be available with and without camera, and shall support the following functional modules:
    - 1) ID card reader
    - 2) Fingerprint reader
    - 3) Keypad
    - 4) Button module
    - 5) Touch screen
    - 6) Bluetooth
    - 7) Wiegand interface
  - e. The intercom shall be equipped with an IR-sensitive progressive scan megapixel sensor and be able to provide images also under dark conditions.
  - f. The intercom shall be equipped with built-in power adaptive IR-illumination/LED.
  - g. The camera shall provide an automatic IR-cut filter, providing day/night functionality.
2. The intercom shall meet or exceed the following performance specifications:
  - a. Video
    - 1) The intercom shall provide video streams in 640x480 at up to 30 frames per second using H.264, H.263, H.263+ or up to 15 frames per second using MJPEG.
    - 2) The intercom camera shall provide images in resolutions up to 1280x960.
    - 3) The intercom shall support the following video encoding algorithms:
      - a) H.263+
      - b) H.263
      - c) H.264
      - d) MPEG-4 Part 2
      - e) MJPEG
    - 4) The intercom shall provide independently configured simultaneous H.264 and MJPEG streams.
    - 5) The intercom shall in H.263, H.263+, H.264 support Constant Bit Rate (CBR) to protect the network from unexpected bit rate peaks.
    - 6) The intercom shall provide configurable compression levels.
    - 7) Support standard baseline profile H.264 with motion estimation.
    - 8) Support motion estimation in H.264/MPEG-4 Part 10/AVC.
    - 9) The intercom shall allow for video to be transported over:
      - a) HTTP (Unicast)
      - b) HTTPS (Unicast)
      - c) RTP (Unicast & Multicast)
      - d) RTP over RTSP (Unicast)
      - e) RTP over RTSP over HTTP (Unicast)
    - 10) The intercom shall support Quality of Service (QoS) to be able to prioritize traffic.
  - b. Image
    - 1) The camera shall incorporate automatic white balance.
    - 2) The camera shall support manually defined values for:
      - a) Color level
      - b) Brightness
  - c. Audio
    - 1) The intercom shall support two-way full duplex audio:
      - a) Input sources

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- (1) Internal microphone
    - b) Output sources
      - (1) Built-in speaker, 2W
      - (2) Line out
  - 2) The intercom shall support separately adjustable volume levels for:
    - a) Call
    - b) Key
    - c) Ring tones
    - d) Preloaded audio clips
    - e) Warning tones
    - f) Paging
  - 3) The intercom shall support adaptive gain control.
  - 4) Encoding
    - a) The intercom shall support:
      - (1) G.711
      - (2) G.722 (wideband)
      - (3) G.729
      - (4) L16 / 16kHz (wideband)
  - 5) The intercom shall provide a sound pressure level of at least 78dB at 1kHz at 1m.
  - 6) The intercom shall be equipped with active echo cancellation.
  - 7) The intercom shall allow for audio to be transported over:
    - a) RTP (Unicast & Multicast)
    - b) RTP over RTSP (Unicast)
    - c) RTP over RTSP over HTTP (Unicast)
  - 8) The intercom shall support Quality of Service (QoS) to be able to prioritize traffic.
- d. Call functionality
- 1) The intercom shall support SIP for integration with VoIP, peer-to-peer or integrated into SIP/PBX.
  - 2. The intercom shall support the use of SIP Proxy, which can be the same as the SIP registrar for outgoing calls.
  - 3) The intercom shall support dialing up to twelve separate numbers in sequence or as ring group.
- e. Access control functionality
- 1) The intercoms' reader outputs shall be wired through the Weigand module to the existing access control system.
- f. User Interface
- 1) Web server
    - a) The intercom shall contain a built-in web server making functionality and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.
  - 2) IP addresses
    - a) The intercom shall be set with dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.
    - b) The intercom shall allow for automatic detection of the intercom based on WS Discovery when using a computer with an operating system supporting this feature.
    - c) The intercom shall provide support for IPv4.
- g. Event functionality
- 1) The intercom shall be equipped with an integrated event functionality, which can be triggered by:
    - a) Tamper / case open
    - b) SIP Call state incl. incoming call
    - c) Change of SIP registration status
    - d) Video Motion Detection
    - e) Noise Detection
    - f) SIP DTMF sequences
    - g) External input
    - h) Access control events such as code, card, fingerprint entered

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- i. Predefined time
  - 2) Response to triggers shall include:
    - a) Send notification, using HTTP or email
    - b) Activate sound alarm
    - c) Make or end call
    - d) Send notification, using HTTP, HTTPS, Wiegand or email
    - e) Send images, using FTP or email
    - f) Activating external output
    - g) Play audio clip
- h. Protocol
  - 1) The intercom shall incorporate support for at least HTTP, HTTPS, SIP 2.0, TFTP, RTSP, RTP, SMTP, DHCP opt 66, NTP, Syslog.
  - 2) The SMTP implementation shall include support for SMTP authentication.
  - 3) The camera shall incorporate support for at least IPv4, HTTP, HTTPS, SIP, SSL/TLS, QoS Layer 3 DiffServ, TCP, ICMP, SNMPv2c, RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, ARP, DNS, NTP,
- i. Security
  - 1) The intercom shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.
  - 2) The intercom shall block its login page for 30 seconds after three faulty passwords have been submitted.
  - 3) The intercom shall force user to change admin password upon first installation.
  - 4) The intercom shall provide centralized certificate management, with the ability to upload CA certificates. The certificates shall be signed by an organization providing digital trust services.
  - 5) The intercom shall support IEEE 802.1X authentication.
  - 6) Selected services, such as RTSP or web config shall be configurable to only allow access from local devices.
  - 7) The intercom shall restrict access to the built-in web server by username and password.
  - 8) The intercom shall be equipped with tamper detection.
- j. API support:
  - 1) The intercom shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.
  - 2) The intercom shall conform to ONVIF profile S as defined by the ONVIF Organization.
    - a) For ONVIF profile specifications, see [www.onvif.org/](http://www.onvif.org/)
  - 3) The intercom shall be interoperable/certified with major PBX and gateway manufacturers, including:
    - a) Cisco
    - b) Avaya
    - c) Broadsoft
- k. Installation and maintenance
  - 1) The intercom shall support secure configuration using HTTPS.
  - 2) The intercom shall support the use of SNMP-based management tools according to SNMP v2c.
  - 3) The intercom shall allow updates of the software (firmware) over the network, using TFTP, HTTP or web interface.
  - 4) The intercom shall be time synchronized to the district NTP (Network Time Protocol) server.
  - 5) The intercom shall support back-up and restore of configuration.
  - 6) The intercom shall store all customer-specific settings in a non-volatile memory that shall not be lost during power cuts or soft reset.
- l. Access log
  - 1) The intercom shall be able to log events such as codes, phone calls, RFID cards etc., and provide them using HTTP interface for monitoring.

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- 2) The administrator shall be able to set whether the particular messages are sent by the intercom immediately after any event occurs, or if the client registers for event logging and then asks for full report since last registration, all events at once.
- 3) The client shall be able to select which messages are reported from event log.
- m. Intercom diagnostics
  - 1) The intercom shall be equipped with LEDs, capable of providing visible status information. LEDs shall indicate the intercom's operational status and provide information about power, the network status and the intercom status.
  - 2) The intercom shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes or restart the unit if a malfunction is detected.
- n. Hardware interfaces
  - 1) Network interface
    - a) The intercom shall be equipped with one 10BASE-T/100BASE-TX Fast Ethernet-port, using a standard RJ45 connector and shall support auto negotiation of network speed (100 MBit/s and 10 MBit/s) and transfer mode (full and half duplex).
  - 2) Doors
    - a) The intercom shall be equipped with programmable input supporting both short circuit activation or up to +30VDC for door monitor or Request to Exit (REX).
    - b) The intercom shall be equipped with two independent outputs for door control. One active providing at least 8VDC / 400mA and one NO/NC relay supporting up to 30V AC/DC 1A.
  - 3) Audio
    - a) The intercom shall be equipped with line output.
  - 4) Power
    - a) The intercom shall be equipped with a removable terminal block providing connectivity for external power.
  - 5) Multifunctional connector
    - a) The camera shall, by using a "multi wire ribbon cable", provide connectivity between main unit and modules.
- o. Enclosure
  - 1) The intercom shall:
    - a) Be manufactured with IP54 rated housing, and be IK08 (IK07 when using Touchscreen module).
    - b) Be fitted with a tamper switch.
    - c) Be of modular design, supporting main unit and up to 29 additional modules.
    - d) Be available in black and brushed nickel versions.
- p. Power
  - 1) Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 0
  - 2) 12 V DC
    - a) Max: 2A
- q. Environmental
  - 1) The intercom shall:
    - a) Operate in a temperature range of -40 °C to +60 °C (-40 °F to 140 °F)
    - b) Operate in a humidity range of 10–95% RH (non-condensing).

## 2.4 NETWORK STROBE SIREN

- A. Axis D4100-E Network Strobe Siren.
  1. Connect Network Strobe Siren to associated 2N door station as indicated on drawings. Contractor to provide and install 1-18/4 conductor from 2N door station to strobe siren.
  2. Program system so that green strobe and sounder is activated when door station is activated. Coordinate sound levels with owner.

## PART 3 - EXECUTION

### DOOR INTERCOM SYSTEM

3.1 INSTALLATION

- A. The Contractor shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate complete system.
- B. All equipment shall be configured in accordance with instructions provided by the manufacturer and systems administrator prior to district inspection.
- C. All firmware found in products shall be the latest and most up-to-date provided by the manufacturer.
- D. The contractor shall provide a 2N Indoor Touch 2.0 master station at the primary operator's desk with its appropriate stand.
- E. Contractor is responsible for working with other trades to ensure proper installation of all devices per recommended codes.
- F. All equipment requiring users to log on using a password shall be configured with district specific password. No system/product default passwords shall be allowed.

END OF SECTION

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VIDEO SURVEILLANCE SYSTEM (VSS)

PART 1-GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
1. Conditions of the Contract
  2. Division 1
  3. Division 26
  4. Division 27
  5. Division 28

1.2 DESCRIPTION OF WORK

- A. Expand existing system with a complete and tested IP based digital video surveillance system (VSS) including cameras, cabling, digital image storage, integration and accessibility with Owner's Local/Wide Area Network (LAN/WAN), Internet accessibility thru remote view application software and simultaneous user access capability. Provide fully terminated unshielded twisted pair (UTP) cable, UTP terminations, racks, raceways, conduit, and other incidental and miscellaneous premises wiring system hardware as required for a complete and useable system. The installation shall comply with applicable codes and standards in effect at the job site and as indicated in the Specifications and Drawings.
- B. The system shall be Non-Proprietary in nature and be available through multiple distribution channels in the nearest metropolitan marketplace. Systems that are manufactured and installed by a factory office and are not available through multiple distribution channels will not be accepted.
- C. Provide all electronic hardware and coordinate with the building's LAN/WAN. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.
- D. Acceptable manufacturers of NVR equipment shall be GCON Systems Enterprise Class NVR System or BCD Video Network Video Recorder only. Contractor must be a current Exacq Enterprise Certified integrator of the solution in the Houston marketplace and be able to include information on current support staff to be able to service this client. Seneca NVR part numbers and configuration are listed in the specification to define equipment capabilities and requirements for this project.
- E. Contractor must be a current integrator of solution in the Houston marketplace and be able to include information on current support staff to be able to service this client as needed 24x7 for emergency support.
- F. Contractor shall provide a complete turnkey solution to the owner and be responsible for the complete installation of a security camera system.
- G. The contractor must be in good standing with the district and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the contractors bid.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
1. The Video Surveillance System Installer shall be Exacq Enterprise certified and shall meet all applicable regulations. The Contractor shall be a firm normally employed in the security and surveillance industry.
  2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacture indicating they are a dealer in good standing.
  3. The contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.
  4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The

VIDEO SURVEILLANCE SYSTEM (VSS)



contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.

5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
  - a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
  - b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
  - c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
  - d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
  - e. Any subcontractor who shall assist the video surveillance contractor in performance of this work shall have the same training and certification as the video surveillance contractor.
- B. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

#### 1.4 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
  1. Local Building Code
  2. Local Electrical Code
  3. NEC National Electrical Code
- B. Other references:
  1. TIA/EIA-568-A - Commercial Building Telecommunications Wiring Standard
  2. EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
  3. TIA/EIA-606 - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
  4. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
  5. TIA/EIA TSB 67 - Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
  6. ISO/IEC 11801 - Generic Cabling Standard
  7. EN 50173 - Generic Cabling Standards for Customer Premises
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

#### 1.5 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
  1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
  2. Product Literature: Complete manufacturer's product literature for all material, hardware, and equipment to be used in the installation of the specified system. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
  3. Construction Schedule: A time-scaled Construction Schedule, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
  4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.

#### VIDEO SURVEILLANCE SYSTEM (VSS)

5. Each Submittal must have a detailed parts list. Quantities will not be required as the quantity of any portion of this system shall be as required for a complete and functional system and in conjunction with the contract documents.
6. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
  - a. Physical Security Professional (PSP) Certification: This certification must be held by an on-staff, full-time employee of the system installer. The holder must be staffed out of the office that is located within 75 miles of the project.
  - b. Manufacturer Authorized Dealer Certification must be held by the system installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
  - c. Installer Certifications: Certification indicating that an individual has successfully completed installer training, issued by the VMS and Cameras Manufacturers specified herein, must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
  1. Proposed cable routing and grouping plan.
  2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
    - a. Location of sleeved wall and floor pass-thru
    - b. Size of sleeve at each location installed
    - c. Quantity of cable passing through each sleeve
    - d. Location of devices and head end equipment.
    - e. Conduit routing, size, and quantity
  3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
  4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.
- C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.
- D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
  1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
  2. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
  3. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
  4. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
  5. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
  6. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be

prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.

7. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
8. A copy of the manufacturer's warranty on the installed system.
9. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
10. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
11. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.

#### 1.6 QUALITY ASSURANCE

##### A. Contractor Qualifications:

1. The system installer shall be the authorized representative of the manufacturer to sell, install, and service the proposed manufacturer's equipment. The system installer shall have represented the security alarm manufacturer's product for a minimum of five (5) years' with experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
2. The system installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
3. The system installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security systems for at least ten (10) years.
5. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
6. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Access Control, Audio / Video Intercom, and the Intrusion Detection systems as well as the system specified in this section.
7. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
8. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
9. The system installer shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
10. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
11. Contractor must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor for performing any work on the project.

#### 1.7 PRE-INSTALLATION MEETINGS

- ##### A.
- No less than a minimum of two weeks prior to rough-in or installation of any system devices, the Installer will be required to attend a pre-construction meeting with the Owner, Architect, and Security Consultant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

- A. The VSS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 -PRODUCTS

2.1 GENERAL

- A. The data cabling to each camera location on this project shall be provided and installed by the data cabling contractor. The security camera installing contractor shall be responsible for the installation of all power wiring for exterior PTZ domes and power supplies.
- B. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- C. Materials shall be as listed no alternate products will be allowed without prior consent of the projects security consultant. Any items approved as equivalent products shall be published by addendum ten days prior to proposal for Architect/Engineer review.
- D. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer's system.
- E. All systems and components shall have been thoroughly tested and proven in actual use.
- F. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.
- G. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

- A. Provide and Install new Tripplite, #B030-008-17-IP, NetDirector 8-Port 1U Rack-Mount Console HDMI KVM Switch with 17 in. LCD and IP Remote Access, Dual Rail.
- B. Security contractor is responsible to coordinate with district police technology department on acquiring network connections as well as any network configuration information such as IP numbers that will be required to connect NVR servers to district network.
- C. Security contractor is responsible to provide network cabling connection, either fiber or category 6A, to owner provided network equipment. This connection allows NVR to be connected to owner's local area network.
- D. Security contractor shall provide (1) Minuteman – E2000RTXL2U ups per NVR unit at each rack location to support NVR equipment. Provide 120v. electrical connection at location where NVR is installed.

2.3 CABLE AND INSTALLATION

- A. The Contractor shall provide and install all low voltage plenum rated power cable to exterior PTZ dome camera locations from a central power supply(s). Each power cable shall be individually fused at the power supply so a short in one power cable will blow that fuse and not affect the other cameras. The power supply will be UL listed in an approved enclosure. It is the responsibility of the Contractor to size the power supply to handle the full load of the cameras.
- B. The data cabling to each camera location on this project will be provided and installed by cabling contractor certified by Systimax and authorized to install the cable plant and connectivity products. All category 6A cable shall be Systimax Purple 2071 CAT6A.

VIDEO SURVEILLANCE SYSTEM (VSS)

- C. Camera contractor is responsible to request and oversee all penetrations and all conduit runs as necessary for installation of CCTV installation.
- D. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.
- E. All Cameras will require 10ft purple Cat6A patch chord at camera location and 7ft purple Cat6A patch chord at panel location provided by certified Systimax Data contractor.
- F. All outdoor cable runs underground shall be in fiber rated for underground use according to Technology specs.
- G. All power circuits required for the NVR servers are to originate as emergency power from its provided UPS.
- H. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.
- I. All cabling for entire project shall be installed at 5'-0" intervals in dedicated support system using a j-hooks support system. Cable supports will be securely attached directly to building structure. Do not attach cabling or supports to ductwork, piping, grid hangers, conduit, or equipment.
- J. Refer to CFISD structured cabling specifications for Category 6A materials and methods.
- K. All category 6A cabling shall be routed to existing MDF and IDF locations and be terminated on existing racks. Provide additional patch panels as required and label ports using existing labeling scheme.
- L. For all cameras that will exceed the maximum category 6A cable limitation the contractor shall provide and install Veracity Outreach Max universal Ethernet and Poe Extender and clearly identify on as-builts. If installed a spare unit will be provided to the owner.

#### 2.4 PROPOSALS

- A. All proposals shall be in the format as shown in the General Conditions Section of the Specification.

#### 2.5 DIGITAL VIDEO RECORDING, MANAGEMENT AND TRANSMISSION SYSTEM

- A. The contractor shall provide and install Network Video Recorders for this project.
- B. Final connection for all new IP cameras shall be provided by the camera contractor. Coordinate all recording settings and functions with owner prior to programming.
- C. Network Video Recorders shall be preprogrammed to include a floor plan graphic of each school and the exact camera locations and name of cameras. Field verification of camera names is required to complete this task.

#### 2.6 EQUIPMENT REQUIRED

- A. Provide a 5-year warranty for all NVR equipment.
- B. Digital Video Recorders:
  - 1. Provide one GCON Systems Enterprise Class NVR System or BCD Video Network Video Recorder, per 50 cameras to be installed unless stated otherwise by the owner.
  - 2. The contractor shall coordinate correct Exacq software version prior to submitting or procuring equipment.
  - 3. NVR must have SSA agreement in place for two years at time of install.
  - 4. In response to proposal, contractor shall provide owner with amounts for annual service maintenance agreement that can be purchased after warranty period has expired.

#### 2.7 CAMERAS

- A. Camera Types:
  - 1. All ceiling mounted cameras shall be surface mounted on the ceiling using ceiling mounting kit and accessible by 10ft ladder.
  - 2. All cameras shown on the drawings to be corner mounted shall receive corner mount kit by specified camera manufacturer, no exception.
  - 3. Interior Fixed cameras shall be Bosch Flexidome 5000i or AXIS P3265LV if primary is not available. – TYPE C
  - 4. Exterior Fixed cameras shall be Bosch Flexidome 5000i or Axis P3265-LVE if primary is not available. – TYPE B
  - 5. Interior Fish Eye cameras shall be Bosch Flexidome 5100I 6mp. – TYPE E
  - 6. Multi sensor Interior/Exterior Camera shall be Axis P3727-PLE or Wisenet PNM-C16083RVQ– TYPE A

#### VIDEO SURVEILLANCE SYSTEM (VSS)

7. Duo Cameras shall be AXIS P4707-PLVE Platform with IR or Wisenet PNM-7082RVD if Axis is unavailable. – TYPE D
  8. Axis F9114 and Axis F4105-LRE sensors shall be provided to view around a column or skylight where a center mounted single camera cannot be employed. All F4105-LRE lens must be installed with Axis TU6005 plenum cable accessory. – TYPE F
  9. Specialty PTZ camera will be Axis Q6318-LE PTZ if specifically called for by owner-TYPE G
- B. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.
  - C. IP camera address scheme will be provided to contractor by the owner. All Camera addresses shall follow the provided scheme and be sequential.
  - D. Refer to Drawings for additional camera part numbers, Quantities.
  - E. Confirmation of camera type per location requires customer verification.

## 2.8 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

- A. Licensing to be provided for all necessary equipment.
- B. Camera mounts and brackets shall be per camera manufacturer.
- C. One ViewSonic VX3211-2K-MHD 32" LED Monitor is required per NVR.
- D. One of each type of camera used on the project is required upon final inspection for spare replacement equipment.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- B. Provide three sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.
- C. Install new conduit on portable pipe supports- (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough- in or installation of system.
- D. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top sides (Not bottom)
- E. Wall Penetrations:
  1. Exterior Penetrations- shall be performed by a certified electrical contractor and be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
  2. Interior Penetrations- shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
- F. Cable Pathway:
  1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 25 cables or less, with cable ties snug, but not deforming the cable geometry. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated cable ties shall be used in all appropriate areas. The Contractor shall adhere to the manufacturer's requirements for bending radius and pulling tension of all cables.
  2. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
  3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

### 3.2 EQUIPMENT RACK CONFIGURATION

- A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- B. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels
- C. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate

## VIDEO SURVEILLANCE SYSTEM (VSS)

wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

### 3.3 WIRING INSTALLATION

- A. General:
  - 1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
  - 2. All cable must be handled with care during installation so as not to change performance specifications.
- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval, and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, except in unfinished mechanical rooms or wiring closets where cable shall be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide "D" rings or the appropriate cable guides to dress the cable.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routes: All cabling placed in ceiling areas must be in conduit, cable tray, or J- Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Caddy CAT 21 or CAT 32 hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36" maximum centers to hang cable. Cable shall be routed so as to provide a minimum of 18" spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be banded together every 6 feet.

### 3.4 DOCUMENTATION

- A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.
- B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.
- C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.
- D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

### 3.5 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

- A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.
- D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.6 INSPECTION

- A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner / Architect / Engineer may observe before acceptance.

3.7 WARRANTY

- A. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion.
- B. Guarantee and warrant all equipment provided for a period of 3 years following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration. All such warranties shall include all parts (NVR's, and Cameras).

END OF SECTION





SECTION 28 31 00

INTRUSION DETECTION SYSTEM (IDS)

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following sections shall associate with this specification as applicable.
  - 1. General Conditions
  - 2. Supplementary Conditions
  - 3. Division 1
  - 4. Division 26 in its entirety.
  - 5. Division 27 in its entirety.
  - 6. Division 28 in its entirety.

1.2 WORK INCLUDED

- A. The Contractor shall furnish and install a complete microprocessor based Intrusion Detection System (IDS) as specified herein. The IDS shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.
- B. IDS devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system, meeting the requirement of specification. The Contractor shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.
- C. The IDS shall include intrusion detection coverage as shown on the system floor plans. Whether shown on the floor plans or not, complete coverage of the following areas shall be included:
  - 1. All access points into the building(s), including but not limited to:
    - a. Doors
    - b. roof hatches
    - c. windows
  - 2. Interior space motion detection at the following locations:
    - a. All level 1 spaces with window and/or doors
    - b. All entrances on any level
- D. The IDS shall be the product of a single manufacturer and consist of, but not be limited to the following:
  - 1. Control Panels
  - 2. Field Devices
  - 3. Enclosures
  - 4. Locks and Keys
  - 6. Power Supplies
  - 7. Accessories required to provide a complete IDS
  - 8. System O and I Manuals
  - 9. System Programming
  - 10. Batteries
  - 11. Wiring
- E. The IDS installer shall be responsible for, but not limited to:
  - 1. Tagging of all conductors and cables at each end.
  - 2. Provision and installation of IDS control panels.
  - 3. Provision and installation of IDS devices.
  - 4. Full coverage of all windows, doors, roof hatches.
  - 6. Preconstruction meeting with Owner's personnel, installing technician and project superintendent.
- F. The contractor shall connect this location to the Owner's monitoring station as designated by the owner.

INTRUSION DETECTION SYSTEM (IDS)

- G. The Contractor shall be responsible for identifying requirements for permits, from the local the Local Authority Having Jurisdiction (AHJ), for the installation of the alarm system specified herein and shall assist the Owner in obtaining the relevant alarm permits.
- H. All conduits and back boxes shall be provided and installed by the project's electrical contractor. In the event that there is no electrical contractor on the project, responsibility will be that of the IDS installer.
- I. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.
- J. Contractor shall integrate all Emergency Eyewash systems into the IDS. Provide cabling connecting both systems. Coordinate with Emergency Eyewash systems contractor.
- K. Contractor shall connect the Intrusion Detection System to the electrical automatic transfer switch in order to notify the District Police Department when the building is on emergency power. Provide same, connected to existing transfer switch at the existing Commons building, servicing the existing High School buildings. Provide all required cabling and devices for fully functional systems.
- L. Project scope is an expansion of the existing system.

### 1.3 CODES AND STANDARDS

- A. The system shall comply with the applicable Codes and Standards as follows:
  - 1. National Electric Code, Article 760.
  - 2. National Fire Alarm Code (NFPA 72).
  - 3. Life Safety Code (NFPA 101)
- B. Administrative Council for Terminal Attachments (ACTA):
  - 1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.
- C. American National Standards Institute (ANSI):
  - 1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- D. California State Fire Marshal (CSFM):
  - 1. Title 19, California Code of Regulations, Building Material Listing Program (BML).
- E. Federal Communications Commission (FCC):
  - 1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.
  - 2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).
- F. The National Institute of Standards and Technology of the United States of America (NIST):
  - 1. Federal Information Processing Standards Publications 197 (FIPS 197) –Advanced Encryption Standard (AES).
- G. International Organization for Standardization (ISO):
  - 1. 9001 - Quality System.
- H. Underwriters Laboratories, Inc. (UL):
  - 1. UL 50 - Enclosures for Electrical Equipment.
  - 2. UL 294 – Access Control System Units.
  - 3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.

### INTRUSION DETECTION SYSTEM (IDS)

4. UL 609 - Local Burglar Alarm Units and Systems.
5. UL 864 - Control Units System for Fire-Protective Signaling System.
6. UL 985 - Household Fire Warning System Units.
7. UL 1023 - Household Burglar Alarm System Units.
8. UL 1076 – Proprietary Burglar Alarm Units and Systems
9. UL 1610 - Central Station Burglar-Alarm Units.
10. UL 60950-1 - Information Technology Equipment - Safety.
11. UL 636 – Hold up alarms

- I. Local & State Building Codes
- J. Requirements of Local Authorities having Jurisdiction
- K. Requirements of American Disabilities Act (Public law 101-336).
- L. Texas Accessibility Standards (TAS)
- M. State Fire Marshall.
- N. State Insurance Code.

#### 1.4 QUALITY ASSURANCE

- A. Contractor Qualifications:
  1. The installing contractor shall be the authorized representative of the IDS authorized/certified to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the IDS manufacturer's product for at least five (5) years.
  2. The installing contractor shall be certified to install and setup the IDS software with Security Engine and Access Engine Modules attached.
  3. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems and access control system.
  4. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
  5. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
  6. The System Installer must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the specified IDS. No person is allowed to work on the IDS without proper manufacturer's certification.

#### 1.5 SUBMITTALS AND CLOSE-OUT

- A. Product Data: Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
  1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
  2. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
  3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
  4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of

#### INTRUSION DETECTION SYSTEM (IDS)

- reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
5. Certifications: The System Installer shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
- a. Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is an authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
  - b. Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
  - c. Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
  2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
    - a. Location of all control equipment and remote power sources
    - b. Locations of all field devices and outlets
    - c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
    - d. Location of sleeved wall and/or floor pass-thru
    - e. Size of sleeve at each location installed
    - f. Quantity of cable passing through each sleeve
    - g. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
  3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.
- C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:
1. Inspection and Test Reports: During the course of the Project, the System Installer shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The System Installer shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The System Installer shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
  2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
  3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
  4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.

5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
9. A copy of the manufacturer's warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. The System Installer shall provide one complete floor plan sheet at each panel location

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS

- A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: request info (presales.support@us.bosch.com). Web: www.boschsecurity.us.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Division 1

### 2.2 CONTROL COMMUNICATOR (Panel)

- A. The IDS control panel shall be Bosch Security Systems, Inc., model # B9512G comprising a fully integrated intrusion, fire, and access control system. The control panel shall support the following:
  1. The IDS system is capable of being utilized as a combination Intrusion and Fire system per code. Fully integrated intrusion, access and fire functions allow users to interface with 1 system instead of 3
  2. Telephone Line Module Interface with programmable options for signaling and supervision.
  3. Conettix IP based communication option provides high-speed, secure alarm transport and control.
  4. 32 programmable areas with perimeter and interior partitioning.
  5. 8 on-board, class B hardwired points with expansion capability for a total of at minimum 500 wired or wireless points.
  6. Compatibility with touch-screen color LCD, vacuum fluorescent, ATM style LCD or LED style Alarm Command Centers.
  7. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software(RPS).
  8. The system shall support the use of an Apple iOS device for control. Functions to include arming, disarming, control of outputs, lock, unlock, cycle and secure access doors.

9. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
  10. Provide 1.4 amps of power for standby operation and 2 amps of alarm power, both rated at 12 VDC.
  11. 2 wet-contact relay outputs and 1 Auxiliary wet-contact relay output with expansion capability for up to an additional 128 dry-contact relay outputs.
  12. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
  13. Supervision of peripheral devices and communications interface(s).
- B. All small installations such as press boxes or tractor sheds shall use Bosch Model #5512 main control panel.
- C. Programmable features shall include:
1. Independently control zones through an independent zone control keypad.
  2. Automatic test reports.
  3. Selective zone shunting.
  4. Custom text on the associated command centers.
- D. Zone Expansion - Expanded to 500 (8 on-board, 492 off-board) individually annunciated points of protection through the addition of a two-wire multiplex zone expansion system (ZONEX). Points of protection are annunciated with custom text at the B915 Command Center and they can be reported to a Radionics D6600 Receiver.
- E. User Pass Codes – nine hundred ninety-nine (999) user pass codes shall be available to identify the user when arming/disarming the system.
- F. Protective Circuits shall consist of zones designed for fire and/or panic (holdup, duress, or emergency) and/or burglary and/or supervisory. Each zone represents a protective circuit and shall accommodate normally opened and closed devices with end-of-line resistor supervision. Each of the 500 points are programmable as to whether they are controlled versus 24 hours; interior versus perimeter; instant versus delayed; silent versus audible (and if audible, pulsed or steady); and local or reporting.
1. Additional programmable parameters for each point include the ability to suppress trouble or restoral reports, designate it as a priority zone (system cannot be armed if this point is off-normal), report two separate telephone numbers and provide for automatic shunting of points from the system in the event that the detection device malfunctions and creates numerous false alarms.
  2. Each POPIT shall accommodate normally opened and normally closed devices with end-of-line resistor supervisor.
  3. Minimum total points, 500.
- G. Entry/exit delays shall be independently programmable from 10 to 150 seconds. A pre-warn audible shall be coincident with the entry delay.
- H. Programming of all system functions shall be achievable at system site or remotely via the use of the dial-up telephone network. Minimum programmable functions shall include:
1. User pass codes, entry/exit delay times, master zone personality, day/date/time, telephone numbers, point of protection text labels, and bell time.
  2. A programmable system pass code shall be used to prevent unauthorized remote programming attempts.
  3. Remote programming capability shall be automatic or require user enabling at the discretion of the user.
- I. Remote control via the use of the dial-up telephone and owner's local area network shall include:
1. System arming.
  2. Reset of audible signals.
  3. Activation/deactivation of relay contacts.
  4. Interrogation of battery.
  5. Zone and armed status.
  6. Enable/disable of reporting functions and removing reporting devices for servicing while

the remainder of the system is operative.

- J. Recognitions shall include: UL for central station fire and/or burglary, local burglary and/or fire; FM for fire, California Fire Marshal for fire; and NYBSA for fire.
- K. Miscellaneous built-in features shall include:
  - 1. Real-time clock.
  - 2. Interrogator.
  - 3. Auto-answer modem.
  - 4. Phone line monitor.
  - 5. Loop start/ground start telephone interface.
  - 6. Auto bell test.
  - 7. Lug-in terminal strips, and user controlled zone bypass.
- L. Command centers shall be microprocessor-based
  - 1. 16 character illuminated alpha-numeric display.
  - 2. Burglary and fire sounders.
  - 3. Backlight 15-key touchpad.
  - 4. Pre-warn tone.
  - 5. The arming station shall have the ability to annunciate the English language format via the 16 character alphanumeric display by the following:
    - a. Master zone (alarm, service, faulted, and function), POPIT (alarm, service, faulted, missing, extra, function, and location), arm/disarm status (system diagnostics, time/day/date, and user prompts).
  - 6. Additional features shall include local system test, sensor reset, panic and/or medical and/or duress alarm initiation, independent master zone by-pass with automatic restoration to normal status to next system arming, perimeter watch mode, user changeable pass codes, remote programming initiation, and system/monitoring service test.
  - 7. Radionics model B915, and shall be functional at each of the locations shown on the floor plans.
  - 8. Non-school oriented buildings will use Radionics Model B942 Touch Screen Keypads
- M. Modules and Accessories
  - 1. POPEX Module (Zone Expansion B299)
  - 2. B8103 Main Panel Enclosure & D101 Lock set- one required for the main panel and one for each quadrant of the project receiving a B299.
  - 3. D9002-5 6 location 3 hole Mounting plate- adapter used for hanging modules in all expansion panels.
  - 4. B430 Telephone Line Interface
  - 5. B308 Octo-Relay module - provides eight form "C" dry contact relay outputs for a variety of programmable responses to alarm, trouble and other system conditions.
  - 6. Auxiliary power supplies as required for powering of motion detectors, Altronix Power Supply (Part # SMP10PM12P8) - one required for each quadrant of the project receiving a B299.

## 2.2 FIELD DEVICES

- A. Ceiling mounted 360 Degree, infrared sensors / microwave motion sensors. Model DS 9370
  - 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
  - 2. All units must be adjusted/masked to reduce false signals for the covered area.
  - 3. Contractor to provide a dedicated POPIT for each motion detector on the project.
- B. Ceiling mounted 200ft Long Range infrared sensor. Model DS794Z
  - 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
  - 2. All units must be adjusted/masked to reduce false signals for the covered area.
  - 3. Contractor to provide a dedicated POPIT for each motion detector on the project
- C. Wall mounted, high performance, Tri Tech PIR/Microwave sensor, Model ISC-CDL1-W15G
  - 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
  - 2. All units to have areas of coverage, which would cause false alarm signals to be

### INTRUSION DETECTION SYSTEM (IDS)



- generated, masked out and adjusted to reduce false signals.
  - 3. Provide model correct protective wire cage in gymnasiums.
  - 4. Contractor to provide a dedicated POPIT for each motion detector on the project.
- D. Magnetic Door / Hatch / Overhead Contacts
  - 1. Where exposed contacts are used they shall be heavy duty switches protected by die cast aluminum housing and the leads shall be encased in steel armor jacket. The leads must pass through the back box by the correct size twin screw cable clamp connector.
  - 2. Magnetic Door / Hatch contacts shall be model Sentrol 2505A-L contact
  - 3. Overhead Roll up contacts shall be model Ademco 958 contact
  - 4. Contractor to provide a dedicated POPIT for each entry door, set of doors, roof hatch or rollup door on the project.
- E. Glass Break Detector
  - 1. Bracket for direct mounting to standard 3-1/2" and 4" electrical back boxes.
  - 2. Provide model correct protective wire cage in gymnasiums.
  - 3. Glass breaks shall be Model GE 5812-RND or Bosch DS-1108DI
  - 4. Contractor to Provide dedicated POPIT for each room of glass break detectors on the project.
- F. Sirens
  - 1. Shall be installed on Wall / Ceiling within 50 foot of every keypad location.
  - 2. Wired directly to corresponding relay module and not the main control panel.
  - 3. Sirens shall be Model SSX-52 Amseco.

## 2.3 WIRING

- A. All wiring shall be by the manufactures (Bosch/Radionics) specifications. All cable is preferred but not limited to be shielded.
- B. Each area of a building shall provide its own Popex Module(s), Power supply(ies) and enclosure(s) in that areas IDF. All areas considered should be at minimum 500ft from the main panel or as otherwise instructed by owner.
- C. All 120v Power shall be furnished by the contractor.
- D. All Security system conduits as show on the drawings shall be furnished by the contractor as part of their scope of work.
- E. Coordination with the electrical contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.
- F. All systems shall be connected to an emergency power source as available.
- G. Color code of all security intrusion detection system and access control wiring shall be purple in color.
- H. Approved Products:
  - 1. 18/2 unshielded:  
Belden #6300UE0071000  
Tappan Wire & Cable, Inc. #P40020.122
  - 2. 18/4 unshielded:  
Belden #6302UE0071000  
Tappan Wire & Cable, Inc. #P41387.28
  - 3. 18/6 unshielded:  
Belden #6304UE0071000  
Tappan Wire & Cable, Inc.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" not to exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations such as inside walls, all mechanical / electrical rooms, or other areas where wiring might be exposed or subject to Damage.
- G. All vertical wiring and all main trunk / riser wiring shall be installed in a complete raceway / conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- H. Provide a Green Systimax Category 6 telephone cable from the Master Control Panel to the Telephone Equipment room.
- I. (2) 18-4 wires will be run from the panel to the prior designated future portable connection location and labeled in plain English on both ends. These spares are to be left above the ceiling with 10ft of slack at minimum.
- J. Each set of glass breaks that protect one room are to be connected through one POPIT module for point identification of that room.
- K. Magnetic door contacts protecting separate hallways or entries are to be connected into separate POPIT modules for separate identification.
- L. Provide and install (1) dedicated POPIT for each device installed on the project including but, not limited to glass break detectors.
- M. All POPIT Modules shall be installed inside a 4"x4" junction box with a cover to be mounted on the wall nearest to the device the POPIT Module is associated with. All boxes shall be labeled with the appropriate corresponding point contained within.
- N. Integrate the security system to the remote monitoring station. Provide all hardware and cabling as required. Coordinate with Owner for approved remote monitoring service.
- O. All POPIT modules on project shall be mounted above drop ceiling in an area easily accessible by an 8 or 6 ft ladder.
- P. All keypads, sirens and POPEX modules shall have dedicated homeruns from each device to the master control panel. Do not daisy chain keypads or sirens. Chaining of modules is permitted if location serves multiple areas of coverage.
- Q. All POPIT modules and power supplies are required to be located on as-built drawings delivered to owner at or before substantial completion of project.
- R. Contractor shall install communication wire from provided exterior connection at freezer/cooler control panels to burglar alarm via POPIT module interface to notify panel should freezer/cooler encounter high temperature condition. Coordinate programming and testing of module with

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owner.

- S. All POPEX modules and power supplies shall be installed in IDF closets for that area of coverage with easy accessibility and a dedicated SDI2 homerun to the master control panel not to exceed 500ft.
- T. All device power runs shall be fused and clearly labeled in plain English at each main power source.
- U. All Eyewash stations shall have a dedicated POPIT module interface per device on the project and be wired Normally closed for monitoring purposes.
- V. Any generator on site must be monitored through a dry Normally closed contact connection to a dedicated POPIT module and tested to confirm its function for main building AC Loss.

### 3.2 CABLE PATHWAYS

- A. Cable Support:
  - 1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
    - a. Approved Cable Support Manufacturer:  
Panduit Corporation  
Erico/Caddy  
B-Line  
Supports shall be sized appropriately for the number of wires being supported. Reference the manufacturer's specifications for the suggested maximum cables per support size.
  - 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the cable support hook to the treaded rod.
  - 3. The cable support shall be installed at a maximum of 5' on center.
  - 4. All cable installed shall be attached to the cable support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support, to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
  - 5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
  - 6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to insure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
- B. Conduit / Raceway:
  - 1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
  - 2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
  - 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
  - 4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

### 3.3 SYSTEM OPERATION

- A. When an alarm condition is detected by any of the alarm initiating devices, the following functions shall occur:
  - 1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.
  - 2. A custom system alarm message shall be displayed on the LCD display. This display will

show the alarm device location in plain English. Location and partition custom messages shall be field programmable.

3. The remote signaling tie connection shall be activated at the Owner's approved central security monitoring location and/or other Owner designated location.
4. Printer shall provide printed copy of events recorded in logger. Install adjacent to security panel.

#### 3.4 SYSTEM ZONING AND PARTITIONING

- A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.
- B. All zoning/device locations shall be field programmable.
- C. Input control zones shall be coordinated with the owner prior to final programming:

#### 3.5 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

#### 3.6 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.
- B. Any Extended Manufacturer's Warranty will be provided to the Owner if the Sub-contractor entitled to the job has an agreement for an extended warranty already in place with the Manufacturer.

#### 3.7 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Police Technology Foreman after final approval.

END OF SECTION



SECTION 28 46 00

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
  - 1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
  - 2. Supply, install and wire all field hardware, fire alarm control panel, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required.
  - 3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
  - 4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.
- B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this specification. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.
- C. Replace existing system in its entirety to current district standards and code requirements. Existing system shall remain fully functional and monitored until new system is tested and accepted by the AHJ and owner, after which, all devices, panels, and wiring of existing system shall be removed. Coordinate with owner the return of equipment.

1.2 RELATED SECTIONS

- A. Division 22 and Division 23
- B. Sprinkler Systems
- C. Elevators
- D. Food Service

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

- A. National Fire Protection Association (NFPA):
  - 1. NFPA1 Fire Code
  - 2. NFPA 13 Systems, Installation
  - 3. NFPA 17 Dry Chemical Extinguishing Systems
  - 4. NFPA 70 National Electrical Code
  - 5. NFPA 72 National Fire Alarm and Signaling Code.
  - 6. NFPA 80 Fire Doors and Fire Windows
  - 7. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
  - 8. NFPA 92A Smoke Control Systems
  - 9. NFPA 101 Life Safety code.
  - 10. NFPA 105 Smoke Control Door Assemblies
  - 11. NFPA 1221 Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems.
  - 12. NFPA 2001 Fire Extinguishing Systems, Clean Agent
- B. UL: Underwriters Laboratories, Inc.
  - 1. 217 Single and Multiple Station Smoke Detectors.
  - 2. 268 Smoke Detectors for Fire Protective Signaling Services.
  - 3. 864 Control Units for Fire Protective Signaling Services, 9th Edition.
  - 4. 864 Transient protection
  - 5. 1480 Speakers for Fire Protective Signaling Systems
  - 6. UL Fire Protection Equipment Directory.
  - 7. UL Electrical Construction Materials Directory.
- C. Uniform Federal Accessibility Standards (UFAS).

FIRE DETECTION AND ALARM SYSTEM

- D. Factory Mutual P7825 Approval Guide
- E. American National Standards Institute (ANSI).
- F. National Electrical Manufacturer's Association (NEMA).
- G. Institute of Electrical and Electronic Engineers (IEEE).
- H. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
- I. Requirements of American Disabilities Act (Public Law 101-336).
- J. Local Accessibility Standards
- K. State Fire Marshall or Requirements of Local Authorities having Jurisdiction
- L. State Insurance Code
- M. International Building and Fire Code Adopted by Local Authority Having Jurisdiction
- N. Local & State Building Codes
- O. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

- A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years.
- B. Manufacturer's product shall have been in satisfactory operation on three installations of similar size, type and design as this project, for approximately 3 years.
- C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.
- D. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.
- E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.
- F. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.
- G. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.
- H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.
- I. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.
- J. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State Insurance Code.
- K. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems as required by the Texas Board of Professional Engineers.
- L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- M. Material shall be new and in perfect condition when installed.
- N. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.
- O. Quality Control Assurance:
  - 1. All components of the fire alarm system shall be products of an Underwriters Laboratories, Inc. listed fire alarm manufacturer, and shall bear the UL Label. Partial listing shall not be acceptable.
  - 2. All components of the fire alarm systems shall use the most current technology available.

FIRE DETECTION AND ALARM SYSTEM

3. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.
4. All devices shall be tested and certified that they meet or exceed the "Service Life Expectancy Rating" as outlined by UL and NFPA.

1.5 COORDINATION

- A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.
- B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

1.6 DEFINITIONS

- A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
  1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
    - a. The operation of a manual station.
    - b. The operation of a fire suppression system switch.
  2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require and immediate response, but do not require immediate notification of the Fire Department.
  3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
  4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
  5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
  6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
  7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
  8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

- A. Contractor shall meet with Owner's Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.
- B. Before the final set of shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the authorities having jurisdiction (AHJ).
- C. All preliminary and as-built design drawings and supporting documentation shall include: Floor Plan Drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.
  1. Name of Owner and Occupant
  2. Date
  3. Location, including street address.
  4. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
  5. Device Legend
  6. Input/output programming matrix
  7. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
  8. Battery calculations
  9. Notification appliance circuit voltage drop calculations
  10. Floor Plan
    - a. Floor identification

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- b. Point of compass
- c. Correct graphic scale
- d. All walls and doors
- e. All partitions extending to within 15 percent of ceiling height
- f. Room descriptions
- g. Fire alarm device / component locations
  - 1) Signal notification devices
  - 2) Initiation devices
  - 3) Smoke control systems
  - 4) Initiation of automatic extinguishing equipment
  - 5) Doors that unlock or close automatically
  - 6) Zone verification for detection devices
  - 7) Fire/Smoke damper control
  - 8) Fire alarm panel location
  - 9) Fire alarm annunciators
  - 10) Control valves to Fire Protection System
  - 11) Duct smoke detectors
  - 12) Supervisory devices
  - 13) Elevator location
  - 14) Elevator recall system location
- h. Location of fire alarm primary power connections
- i. Location of monitor/control interfaces to other systems
- j. Riser locations
- k. Methods for compliance with NFPA 72 24.3.13 for survivability (emergency voice systems) as required in NFPA 72 12.4 where applicable.
- l. Ceiling height and ceiling construction details
- m. Fire alarm system riser diagram
  - 1) General arrangement of the system, in building cross-section
  - 2) Number of risers
  - 3) Type and number of circuits in each riser
  - 4) Type and number of fire alarm components/devices on each circuit, on each floor or level
- 11. Control unit wiring diagrams shall be provided for all control equipment, power supplies, battery chargers, and annunciators and shall include the following:
  - a. Identification of control equipment depicted
  - b. Location(s)
  - c. All field wiring terminals and terminal identification
  - d. All indicators and manual controls, including the full text of all labels
  - e. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control.
  - f. Typical Wiring Diagram shall be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
- 12. Complete system bill of material of all hardware components.
- 13. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
- 14. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
- 15. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
- 16. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
- 17. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
- 18. Submit sound and visual level to confirm that number and location of signaling devices will provide required sound and visual levels throughout the building.
- 19. Sample of proposed graphic/text annunciation.

#### 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off

#### FIRE DETECTION AND ALARM SYSTEM

sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.

- B. The Operation and Maintenance Manual shall consist of the following:
1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
  2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
  3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
  4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
  5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
  6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
  7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

#### 1.9 AS-BUILT DRAWINGS

- A. Prepare and submit detailed "As-Built" drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

#### 1.10 OPERATIONAL INSTRUCTIONS

- A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers acceptable contingent upon Products' compliance with the specifications:
1. Notifier INSPIRE series or its successor
  2. Siemens-Cerberus PRO Modular
- B. Additional Instructions
1. All equipment, materials, accessories, devices, etc. covered by this standard and/or noted

on the contract drawings shall be new and unused and be U.L. listed for their intended use.

2. All equipment provided shall be available for purchase from at least two authorized distributors within the greater Houston metropolitan area. Single source proprietary equipment is prohibited unless approved by CFISD.

## 2.2 SYSTEM DESCRIPTION

- A. System shall be a completely multiplexed addressable fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified, shall have voice alarm notification wherever audible notification is required.
- B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
  1. Alarm
  2. Trouble.
  3. Open
  4. Short
  5. Device missing/failed.
- C. System circuits shall be wired as follows: Notification Appliance Circuit (NAC) shall be Style B supervised and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.
- D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.
- E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.
- F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- G. Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble.
- H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green "power on" LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.
- I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.
- J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.
- K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.
- L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.
- M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.
- N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.
- O. A maximum of 75 percent capacity of addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.
- P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

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- Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.
- R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style B circuit. Plenum rated fire alarm cable shall have an outer jacket insulation color of red.
  - Minimum wire size shall be:
    - Initiating Circuits: 18 AWG
    - Strobe Circuits: 14 AWG
    - Relay Control Circuits: 18 AWG
    - Voice/Speaker Circuits: 16 AWG
- S. Each panel extender shall have an individual address.

### 2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500 addressable points.
- B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.
- C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.
- D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.
- E. The following primary controls shall be visible through a front access panel:
  - 1. Minimum 3-lines, minimum 40 alphanumeric characters per line display.
  - 2. Individual red system alarm LED.
  - 3. Individual yellow supervisory service LED.
  - 4. Individual yellow trouble LED.
  - 5. Green "power on" LED.
  - 6. Alarm acknowledge key.
  - 7. Trouble acknowledge key.
  - 8. Alarm silence key.
  - 9. System reset key.
- F. Under normal condition, the front panel shall display a "SYSTEM IS NORMAL" message and the current time and date.
- G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- H. System Display:
  - 1. The system shall support the following display mode options:
  - 2. The display shall include a minimum 80-character backlit alphanumeric Liquid Crystal Display (LCD) or comprehensive LCD wide format display or graphic user interface (GUI).
  - 3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
  - 4. The display shall also provide Light-Emitting Diodes.
    - a. The display shall provide minimum 8 Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters:
      - AC POWER
      - FIRE ALARM
      - PRE-ALARM WARNING
      - SECURITY ALARM

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SUPERVISORY SIGNAL  
SYSTEM TROUBLE  
DISABLED POINTS  
ALARM SILENCED

5. The display shall also provide keypad functions.
  - a. The display keypad shall be an easy to use QWERTY type keypad, similar to a lap-top PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
- I. Alarm conditions shall be displayed on the alphanumeric display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The alphanumeric display shall show the new alarm information.
- J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.
- K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, "END of LIST".
- L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.
- M. Alarm silencing:
  1. Should the "Alarm Silence" button be pressed, all audible alarm signals shall cease operation.
  2. Visual signals shall not be extinguished during alarm silence inhibit mode.
- N. System reset:
  1. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The alphanumeric display or reset LED shall step the user through the reset process with simple English Language messages.
  2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.
  3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.
- O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
  1. HVAC - Bypass
  2. Indicating appliance circuits bypass
  3. Auxiliary relays points bypass
  4. All other input/output points.
- P. The following status data or their equivalent shall be available:
  1. Primary state of point.
  2. Device, PID and card type information.
  3. Current priority of outputs.
  4. Disable/enable status.
  5. Verification tallies of initiating devices.
  6. Automatic/manual control status of output points.
  7. Acknowledge status.
  8. Relay status.
- Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the alphanumeric display shall display the module and LED location numbers to facilitate location of that LED.
- R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.

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- S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
  2. LED testing.
  3. Alarm, trouble, and abnormal condition listing.
  4. Enabling and disabling of each monitor point separately.
  5. Activation and deactivation of each control point separately.
  6. Changing operator access levels.
  7. Walk test enable.
  8. Running diagnostic function.
  9. Displaying software revision level.
  10. Displaying historical logs.
  11. Displaying card status.
  12. Point listing.
  13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
    - a. All points list by address.
    - b. Monitor point list.
    - c. Signal list.
    - d. Auxiliary control list.
    - e. Feedback point list.
    - f. LED/switch status list.
  14. Fire Drill:
    - a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.
    - b. Activation of any trouble or alarm condition shall supercede the evacuation drill.
    - c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.
  15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.
  16. The alphanumeric display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper and lower case letters. Lower case letters shall be used for soft key titles and prompting the user. Upper case letters shall be used for system status information. A cursor shall be visible when entering information.
  17. The system shall be capable of being tested by one person. The actuation of the "enable walk test" program at the fire alarm control panel shall activate the "Walk Test" mode of the system, which shall cause the following to occur:
    - a. The remote monitoring circuit connection shall be bypassed.
    - b. Control relay functions shall be bypassed.
    - c. The control panels shall show a trouble condition.
    - d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.
    - e. The panel shall automatically reset itself after signaling is complete.
    - f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
    - g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
    - h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.
  18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.
    - a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual "\*" in the 80 character display.
    - b. When a correct pass code is entered, the new access level shall be in effect until

- the operator manually logs out or the keypad has been inactive for ten (10) minutes.
  - c. Should an invalid code be input, access shall be denied.
  - d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
  - e. The following keys/switches, or their equivalent shall have access levels associated with them:
    - Set time/date.
    - Manual control
    - Disable/enable
    - Clear historical alarm log
    - Clear historical trouble log
    - Walk test
    - Change alarm verification
  - f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
    - Alarm Silence
    - System Reset
    - Acknowledge
19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
20. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.
21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
- a. The following Historical Alarm log events shall be stored:
    - Alarms
    - Alarm acknowledgment
    - Alarm silence
    - System reset
    - Alarm historical log cleared
  - b. The following historical trouble log events shall be stored:
    - Trouble conditions
    - Supervisory alarms
    - Trouble acknowledgment
    - Supervisory acknowledgment
    - Alarm verification tallies
    - Walk tests results
    - Trouble historical log cleared
23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed

- number, a trouble condition shall occur.
25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory service LED "ON" indicating the off-normal condition.
26. Activation of an auxiliary bypass key shall override the selected automatic functions.
27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
28. RS-232-C output: the fire alarm control panel shall be capable of operating remote generic consumer type printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting and supervising a remote display and printer. Data amplifiers shall be used to increase data line distance when required.
29. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet allowing full view of the various displays and controls.
- T. The fire alarm control panel shall have a 25% spare initiating point and battery capacity for future use.
- U. The power supply shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.
1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
  2. Surge protection shall be integral to the control panels.
  3. Each power supply shall be monitored and have an individual address.
- V. Network (IP) Interface Card:
1. IP Communicator module for fire alarm panel
  2. Programmed for remote monitoring of system
  3. Supervise IP Ethernet connection every 90-seconds or less
  4. Coordinate with owner for address for campus data network
  5. Program for Point ID, providing point address/description reporting
- W. Cellular Communicator:
1. UL 864 listed
  2. Panel powered
  3. Upload/Download capable
  4. Transmit all signals and information from the DTMF communicator
  5. Program for Point ID, providing point address/description reporting
- X. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors shall be capable of "Day-Night" automatic sensitivity adjustments.
- Y. Control Switches:
1. Acknowledge/step Switch
  2. Signal Silence Switch
  3. System Reset Switch
  4. System Test Switch
  5. Lamp Test
- Z. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device



individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.

AA. Emergency voice alarm communication system:

1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM TROUBLE LED.
3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
4. The Voice Communications System shall be able to detect a brownout condition on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.
7. An alarm condition shall cause an audible signal and a red LED to activate. A Voice Communication System with a digital message player / recorder shall produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.
8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

2.4 FIELD DEVICES

- A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.
- B. Visual Signals:
  1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC.

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- The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
2. If required to be mounted in student toilets / restrooms, gymnasiums, student locker / dressing rooms shall have a protective cover.
- C. Combination Alarm Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
  2. All combination audio / visual devices mounted in student toilets / restrooms, gymnasiums, and student locker / dressing rooms shall have a protective cover.
  3. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.
- D. Exterior Audible / Visual Signal:
1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.
- E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
  2. If required to be wall mounted in student toilets, gymnasiums, corridors, student locker / dressing rooms, provide wire guard protective cover.
  3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a xenon strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
  4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.
- F. Ceiling mounted recessed mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle in gypboard or plaster ceilings, provide 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.
- G. Surface mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.
- H. Addressable Manual Pull Stations:
1. The manual station shall provide address-setting means using rotary decimal switches. No binary coding shall be required.
  2. Manual stations shall be designed for semi-flush mounting on standard electrical box. The station shall be constructed of hi-impact red molded Lexan with instructions for station operation in raised white letters. Stations shall be of the dual action type.
  3. Install Stopper STI1100 series covers with horns on all manual pull stations, except at the FACP and Remote Annunciator.

FIRE DETECTION AND ALARM SYSTEM

4. Do not specify or use ionization only type detectors unless reviewed and approved by CFISD. Multi-criteria detectors that include ionization detection as one of the criteria to initiate and alarm are acceptable.
- I. Intelligent Photoelectric Smoke Detectors:
  1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
  2. The detectors shall provide address-setting means electronically and automatically at the control panel and programmed for alarm verification.
  3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base. No radioactive material shall be used.
  5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
- J. Duct photoelectric smoke detectors:
  1. Detectors shall be analog addressable type.
  2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
  3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
  4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
  5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
  6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
  7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
  8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  9. The detectors shall provide address setting means electronically and automatically from the control panel and programmed for alarm verification.
- K. Intelligent Thermal Detectors:
  1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
  2. The detectors shall provide address-setting means electronically and automatically at the control panel.
  3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  4. The detector shall be semi-flush ceiling mounted and be provided with modular detector

- head with twist-lock base.
5. Thermal Detectors shall be combination rate-of-rise and fixed-temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as specified and where required by local code authority.
6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.
- L. Addressable Carbon Monoxide Detection:
1. System sensor #CO1224 with addressable identification of the CO Detector's alarm and trouble contact status. UL listed to Standard 2075 Standard for Gas and Vapor Detectors and Sensors.
2. Unit to be powered by the fire alarm system non-resettable 24 VDC supervised power supply.
3. Electro-chemical CO detection.
4. Integral 85db local alarm with local hush/test switch for silence or test.
5. Alarm contacts and trouble contacts for detector trouble, loss of power, and end of life.
- M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.
- N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.
- O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices.
2. The monitor module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.
- P. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.
- Q. Auxiliary Interface Points: All auxiliary input points (fire suppression hoods, water flow, fire pump, AHU shut-down points, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.
- R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.
- 2.5 VESDA – VERY EARLY WARNING ASPIRATING SMOKE DETECTION SYSTEM
- A. Approved Manufacturers:
1. System Sensor (FASAST) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
2. Xtralis (VESDA) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
- B. A Very Early Warning Smoke Detection System similar to the VESDA VLI System shall be installed throughout the cooler and freezer storage areas 200 square feet and larger, and as an alternative

to beam type detectors at high ceiling areas with difficult access.. The system shall consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes, intelligent filtration arrangement with fail-safe operation, sub-sampling probe (inertial separator), built-in clean air zero capability, local USB configuration port and Ethernet networking port. VESDA detection system shall be networked with the specified Notifier Fire Alarm Control Panel.

C. Design Requirements

1. The system shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modeling tool.
2. It shall be tested and approved to cover up to 2,000m<sup>2</sup> (20,000 sq.ft).
3. It shall have a built-in simple user interface indicating alarm and fault status and include a reset / disable button.
4. It shall provide absolute smoke detection.
5. It shall be approved to provide very early warning smoke detection and provide four alarm levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.05-20% obs/m (0.016–6.4% obs/ft.).
6. The detector shall be specifically designed for industrial applications.
7. It shall consist of a highly sensitive LASER-based smoke detector with in-field clean air zero capability, aspirator, intelligent filter and secondary filter.
8. It shall be modular, with field replaceable detection chamber, aspirator, intelligent filter and secondary filter.
9. It shall have four pipe inlets for sample air.
10. It shall incorporate per pipe ultrasonic flow monitoring and provide staged airflow faults.
11. It shall have a built-in and field replaceable intelligent filter placed after the flow monitoring circuitry.
12. Intelligent filter shall:
  - a. Dilute the sampled air for prolonged detector life.
  - b. Combine sample air from all pipe inlets.
  - c. Divide sampled air into filtered clean air and unfiltered air before mixing them together.
  - d. Use HEPA filter with more than 99% efficiency for filtered clean air i.e. removing more than 99% of contaminant particles of 0.1microns or larger, to provide clean air for dilution.
  - e. Use a mesh/screen for the unfiltered air for protection against lint type of particles.
  - f. Be fail-safe and supervised for correct operation with built-in capability to alert for when replacement is required.
  - g. Maintain consistent detector sensitivity over time.
  - h. Have ultrasonic airflow monitoring of the unfiltered sampled air through the intelligent filter.
13. It shall have a field replaceable aspirator after the intelligent filter where the diluted sampled air flows through the aspirator prolonging its life.
14. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 360m (1,200ft) in total, (4 pipe runs per detector) with a transport time per applicable local codes.
15. It shall have a sub-sampling probe (inertial separator) after the aspirator for reduced dust intake in to the detection chamber.
16. It shall have a secondary foam filter after the sub-sampling probe (inertial separator) where the sub-sampled air flows through the foam filter prolonging detection chamber life. The foam filter shall be capable of filtering particles in excess of 20 microns from the sampled air.
17. It shall have a field replaceable smoke detection chamber which stores the calibration values with the chamber assembly.
18. It shall have capability for in-field clean air zero to provide absolute smoke detection.
19. It shall have capability to measure blockages in the air path in to or out of the detection chamber.
20. It shall have an enclosure rating of IP54.
21. The detector shall allow for direct wall mounting or using a supplied mounting plate.
22. It may be inverted as required in specific applications.
23. It shall be self-monitoring for filter contamination.

24. It shall be configured via local USB port with Ethernet port for remote monitoring.
  25. It shall have Fire and Fault relay outputs in addition to three configurable relays. The relays shall be software programmable to the required functions and must be rated at 2 AMP at 30 VDC.
  26. It shall have at least one general purpose input (GPI).
  27. It shall have Power In and Power Out connections to allow powering more than one detector from one power supply.
  28. Optional equipment may include a dedicated Xtralis VSM graphics package.
  29. It shall report any fault on the unit by using configurable fault relay outputs or via PC based configuration and monitoring system.
  30. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events.
- D. Programming Requirements  
Using either USB or Ethernet port the detector shall allow programming of:
1. IP address and related fields to support Ethernet based networking
  2. Four smoke threshold alarm levels
  3. Time delays
  4. Configurable relay outputs for remote indication of detector conditions
  5. Holidays and day/night changeover times
  6. Major and minor airflow fault limits
  7. Aspirator speed
  8. General purpose input function
  9. Alarm and fault latching
- E. Sampling Pipe
1. The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm or 1.05" and internal diameter (ID) of 21mm or ¾" should be used.
  2. The pipe material should be suitable for the environment in which it is installed. VESDA pipe material shall be UL 1887 Plenum rated CPVC).
  3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
  4. The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.
  5. All pipes shall be supported at not less than 1.5m (5ft) centres, or that of the local codes or standards.
  6. The far end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of an end-cap will be dependent on ASPIRE2 calculations.
- F. Sampling Holes
1. Sampling holes shall not be separated by more than allowed for conventional point detectors as required by 30 feet as local codes and standards. Intervals may vary according to calculations. For NFPA the maximum allowable distance is 30ft.
  2. Each sampling point port shall be identified in accordance with Codes or Standards.
  3. Provide per manufacturer's recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.
  4. Sample port size shall be as specified by ASPIRE2 calculations.
- G. Detection Alarm Levels:  
The laser-based ASD system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:
- Alarm Level 1 (Alert)  
Activate a visual and audible alarm in the fire risk area.
- Alarm Level 2 (Action)  
Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.
- Alarm Level 3 (Fire 1)  
Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Monitoring Service and activate all warning systems.
- Alarm Level 4 (Fire 2)  
Activate a suppression system and/or other suitable countermeasures.

The alarm level functions as listed are possible scenarios. Program as directed by Owner to the best utilization of these facilities for each application and the requirements of local A.H.J.

- H. Initial Detection Alarm Settings
1. Alarm Level 1 (Alert) 0.2% obs/m (0.064% obs/ft.)
  2. Alarm Level 2 (Action) 0.3% obs/m (0.096% obs/ft.)
  3. Alarm Level 3 (Fire 1) 0.40% obs/m (0.128% obs/ft.)
  4. Alarm Level 4 (Fire 2) 2.0% obs/m (0.64% obs/ft.)
- I. Initial (factory default) Alarm Delay Thresholds  
Initial (factory default) settings for the alarm delay threshold shall be:
1. Alarm Level 1 (Alert) 10 seconds
  2. Alarm Level 2 (Action) 10 seconds
  3. Alarm Level 3 (Fire 1) 10 seconds
  4. Alarm Level 4 (Fire 2) 10 seconds
- J. Fault Alarms: The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The Minor Fault and Isolate relays shall also be connected to the appropriate control system. Provide as required by local Codes, Standards or Regulations.
- K. Power Supply and Batteries: The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition.
1. UL 1481 Listed -provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
  2. Provide 120-volt 20-amp circuit from the life safety branch panel to each power supply.

## 2.6 AUXILIARY EQUIPMENT MONITORING

- A. The fire alarm system shall monitor for alarm, supervisory, and trouble conditions; and annunciate the status of the following equipment when provided, or is existing to remain, as part of this project. A failed status shall activate the trouble alarm.
1. Emergency Generator: Run Status
  2. Emergency Generator: Trouble Signal
  3. Fire Pump: Run Status
  4. Fire Pump: Trouble Signal
  5. Emergency Service Communications Systems, as required by NFPA 72 and NFPA 1221.

## 2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

- A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.
- B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
  2. Permit the automatic roll down fire doors/shutters to close automatically.
  3. Permit the security grilles with emergency egress to open automatically.
  4. Unlock the electrically controlled access doors in all interior spaces.
- C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.
- D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

## 2.8 REMOTE ALPHA-NUMERIC DISPLAY ANNUNCIATORS

- A. Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an alphanumeric display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The

unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:

1. Integral time-date clock
  2. System reset
  3. System silence
  4. System acknowledge
  5. Display/step switch
  6. Integral trouble buzzer
  7. LCD contrast adjust
  8. Fire Drill Operation
- B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
  2. Individual red system alarm LED
  3. Individual yellow supervisory service LED
  4. Individual yellow trouble LED
  5. Green "POWER ON" LED
  6. Alarm acknowledge key
  7. Trouble acknowledge key
  8. Alarm silence key
  9. System reset key
  10. LED test

2.9 REMOTE PAGING UNIT

- A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

2.10 PRINTER AND PRINTER STAND

- A. Printer and printer stand not required by owner.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.
- B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.
- C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.
- D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.
- E. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.
- F. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.
- G. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.
- H. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.
- I. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has



- been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.
- J. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area and additional annunciators where indicated on the drawings.
  - K. Provide remote paging units adjacent to each remote alphanumeric display annunciator for voice alarm systems.
  - L. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.
  - M. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.
  - N. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.
  - O. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.
  - P. Power for magnetic door holders shall be wired through fire alarm relay.
  - Q. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.
  - R. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel. Label 120V circuit origination (i.e.: "120-Volt Circuit ELA-3")
  - S. Provide smoke detectors in the following locations:
    - 1. All paths of egress and adjoining spaces within the same HVAC envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
    - 2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
    - 3. At each computer lab/room.
    - 4. At each library, library office and library ancillary areas.
    - 5. At each storage room, stock room, or warehouse space.
    - 6. At each pre-K and kindergarten classrooms.
    - 7. At nurse's area/clinic and patient care/cot areas.
    - 8. At each men's and women's restroom/toilet
    - 9. At each administrative work room or copy room.
    - 10. At each student toilet / restroom. Provide STI protective cover. Do not locate over plumbing fixtures or near partitions.
    - 11. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.
  - T. Provide heat/thermal detectors in the following locations:
    - 1. At each electrical room, telecommunications/data room, elevator machine room and mechanical room subject to un-treated or un-filtered outside air.
    - 2. At each janitor's/custodial closets and laundry rooms.
    - 3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
    - 4. At each employee break room/lounge.
    - 5. At each vocational shop.
    - 6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
    - 7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.
  - U. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.
  - V. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger. Where duct smoke detectors are installed above ceilings, provide external remote status/alarm LED mounted flush with ceiling in close proximity to the duct detector location. If space is open without ceiling, wall mount remote status/alarm LED in close proximity to the detector between 96 and 108-inches AFF, or as directed by Owner.
  - W. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.
  - X. Provide VESDA type detectors at the following locations when appropriate:
    - 1. Atriums.
    - 2. High ceiling corridors where maintenance of spot type detectors may be difficult.

#### FIRE DETECTION AND ALARM SYSTEM

3. Areas with skylights.
4. Auditorium Stage
5. Auditorium Seating
6. Main corridor in front of Auditorium
- Y. Provide manual pull stations at FACP in MDF, adjacent to Fire Alarm Annunciator(s) and Greenhouse only, unless required by code otherwise.
- Z. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
  1. Main entry.
  2. Courtyards and outdoor assembly areas adjacent to the building.
  3. Mechanical yards adjacent to the building.
  4. Covered playgrounds or covered assembly areas adjacent to the building.
  5. Additional locations where indicated on drawings.
  6. Outdoor paved play areas.
  7. Greenhouse interior (2 speaker/strobes)
- AA. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.
- BB. Provide carbon monoxide detection in classrooms and other instructional spaces served by a fuel-burning appliance, fuel-burning HVAC equipment (including roof mounted equipment), or with gas fuel outlets for connection to portable fuel-burning space heaters and appliances such as Bunsen burners which are typically used in laboratories or science classrooms.
- CC. Provide smoke detectors, pull stations with stopper covers, and speaker strobes in each classroom in all portable buildings, tied into the main campus fire alarm control panel.
- DD. Provide properly rated and grounded surge suppression for all circuits leaving and entering the building.

### 3.2 CABLE AND BOXES INSTALLATION

- A. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations. Minimum Wire size shall be as follows:
  1. Initiating Circuits: 18 AWG
  2. Strobe Circuits: 14 AWG
  3. Relay Control Circuits: 18AWG
  4. Voice/Speaker Circuits: 16 AWG
- B. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.
- C. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.
- D. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.
- E. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.
- F. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.
- G. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.
- H. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.
- I. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings.
- J. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.
- K. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- L. All junction boxes containing fire alarm wiring are to be painted red and labeled.
- M. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with plenum rated cable zip ties on a maximum of 2'-6". Install cable in D-ring hangers,

- secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork, or foreign equipment.
- N. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.
  - O. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
  - P. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.
  - Q. No other wiring shall be run in the same conduit as fire alarm wiring.
- 3.3 FINISHES
- A. Main Fire Alarm Panel color shall be approved by Owner / Architect.
- 3.4 ALARM SYSTEM SEQUENCE OF OPERATION
- A. General:
    - 1. All fire alarm circuits shall be electrically supervised.
    - 2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.
  - B. Fire alarm operating sequences shall be as follows:
    - 1. Activation of any automatic detector, manual station, fire suppression system, sprinkler flow switch or any other system required by NFPA 72 to be monitored to initiate an alarm condition shall cause the location of the alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
      - a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
      - b. The alphanumeric display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
      - c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
      - d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and received.
      - e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
      - f. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
      - g. De-activate all HVAC systems including low speed high volume (LSHV) circulating blade type fans.
      - h. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
      - i. Close all related smoke dampers.
      - j. Close all related smoke/fire dampers.
      - k. Release all magnetic door hold open devices.
      - l. Release the electric strike, unlocking, but not unlatching, locked doors controlled

- by an access control system.
- m. Release Counter Shutters and hold-open devices on all fire and smoke doors.
- n. Open all security grilles with emergency egress.
- o. Activate to close all related fire and smoke doors and shutters.
- p. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
- q. Signal the building automation system and Owner's security/police personnel as directed by Owner/Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged and appropriate action has been taken.
- r. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
- s. Record all events on the system printer.
- 2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall send an alarm signal to the control panel and also initiate the Alarm Sequence of Operation.
- 3. Activation of a control valve supervisory switch shall initiate the following events:
  - a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
  - b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
  - c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.
- 4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
- 5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
- 6. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.
- 7. When the fire alarm panel is in alarm, the fire alarm panel shall signal the digital lighting control system, as required, to activate and turn all lights to full bright in all NFPA 101 paths of egress and as required by the Fire Marshall. Once the fire alarm (or drill) is cleared, the fire alarm panel shall signal the digital lighting control system as required to enable the digital lighting control system to revert to normal operation with the lights to remain illuminated until manually turned off using the digital lighting control system.
- C. Activation of the manual evacuation (drill) switch shall operate the alarm indicating appliances without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.
- D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

### 3.5 EQUIPMENT IDENTIFICATION

- A. Each panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:
  - 1. Name of manufacturer.
  - 2. Manufacturer's equipment description.
  - 3. Serial number and model number.
  - 4. Voltage and current rating.
- B. All addressable devices shall be labeled with point and module number. Provide label maker style label on base of device. Verify exact requirements with Owner.

## FIRE DETECTION AND ALARM SYSTEM

3.6 SPARE PARTS AND TOOLS

- A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.
- B. Spare Parts: Provide minimum of two, or 5% of building total, whichever is greater unless noted otherwise.
  - 1. Spare shut down modules
  - 2. Spare detectors of each type in the system
  - 3. Spare alarm indicating devices of each type in the system
  - 4. Spare manual pull stations
  - 5. Spare protective covers of each type in the system.
  - 6. Spare relays/controls required for connection to smoke and fire/smoke dampers
  - 7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.
- C. Provide one smoke, heat and carbon monoxide detector testing kit. SDfire #TF2823 with Solo Testfire #2001 tester with 15-foot access pole and three 4-foot pole extensions, detector removal tool, and carrying bag.
- D. Provide two copies of the final software programmed into the fire alarm system.
- E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

- A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

- A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.
- B. Coordinate motor operator voltage with supplier.
- C. Open all dampers prior to starting air handling equipment.
- D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS

- A. Provide two (2) color coded floor plan detailed with project name, actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers.
- B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator. Indicate location of all end-of-line resistors.
- C. Provide graphic floor plans with all fire alarm devices and equipment, with labels and addresses matching system programming and reporting. The floor plan shall be provided in lexan protective covering and framed.
  - 1. Minimum size 30x42 inches, mounted adjacent to FACP in MDF and at remote annunciator.
  - 2. Provide digital copy of graphic floor plan in AutoCAD (.dwg) format.
- D. Provide and mount framed signed FML certificate adjacent to FACP.

3.10 OPERATING INSTRUCTIONS

- A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.
- B. Provide Fire Alarm System Operating Instructions for the following items including, but not limited

to:

1. Alarm Signal
    - a. How to open panel door
    - b. What to read and follow the instruction on display
    - c. How to acknowledge alarm
    - d. How to silence the signals
    - e. How and when to reset the system
    - f. How to return system to normal operation
  2. Trouble / Supervisory
    - a. How to open panel door.
    - b. What to read and follow the instruction on display
    - c. How to acknowledge trouble condition
    - d. Appropriate personnel to respond
- C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

### 3.11 ADDITIONAL REQUIREMENTS

- A. For campuses with existing fire alarm systems, the existing fire alarm system shall remain fully functional and monitored until the new system is fully installed, inspected, and accepted by the AHJ and owner.
- B. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.
- C. Coordinate door hold devices with door and door hardware.
- D. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.
- E. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.
- F. Install system event printer as directed by Owner/Architect.
- G. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.
- H. Provide one dedicated alarm circuit for (future) portable (temporary) building(s) to the nearest main building egress exit discharge to the designated portable building location. Provide 100 feet of cable coiled and marked "FACP-ALARM-PORTABLES" above an accessible ceiling.
- I. Provide one dedicated addressable initiating device circuit with a minimum capacity of 50 devices for (future) portable (temporary) building(s) to the nearest main building egress discharge to the designated portable building location. Provide 100 feet of cable coiled and marked "FACP-INITIATING PORTABLES" above an accessible ceiling.
- J. Provide printer and printer stand at main FACP; exact location as directed by Owner / Architect.
- K. Provide control module relays to interface with the digital lighting control system; refer to specification Section 26 09 28 Digital Lighting Control System. Provide Form C dry contacts to indicate 1) Fire alarm (including fire drill activation) and 2) Fire Alarm cleared.
- L. Provide 40 initiating devices and two audible circuits for portable buildings. These shall be used to service existing portable buildings and remainder shall be left as spare above accessible ceiling.

### 3.12 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.
- B. A state licensed NICET II minimum and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.
- C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Field testing shall include voice intelligibility as required by the latest edition of NFPA 72 Any items found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded and an electronic Excel and printed copy submitted to the Architect, Engineer and Owner.
- D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. The test report shall be signed and dated

- by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be witnessed and accepted by the Owner prior to testing for the local Fire Marshall.
- E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.
- F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:
1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
  2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
  3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
  4. Indicators shall be tested to ensure proper function and operation.
  5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
  6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
  7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
  8. Manual initiating devices:
    - a. Each manual fire alarm station shall be functionally tested for alarm operation.
    - b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
  9. Automatic initiating devices:
    - a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
    - b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
    - c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
  10. Alarm signaling devices:
    - a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
    - b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
    - c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
    - d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
  11. Elevators: Each elevator shall be tested and automatic recall function verified.
  12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.
- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance is to be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.
- H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that

the components are UL listed for function intended.

3.13 SUBSTANTIAL COMPLETION

- A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.
- B. All fire alarm system shop drawings, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.
- C. Acceptance by County or Local Fire Marshall.

3.14 WARRANTY

- A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and remote annunciators. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.
- B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.
- C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.
- E. Provide a certified fire alarm test of the complete system no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts at no cost to the Owner.
- F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of "As-Built" drawings and schematics of all equipment.
- G. All manufacturer's warranties which extend past final completion shall be fully transferred to the Owner.

3.15 TRAINING

- A. Provide training course to all fire personnel assigned by Owner's Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.
- B. Provide a video of the training program to the Owner's Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.
- C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.
- D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

END OF SECTION





SECTION 28 55 00

RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC)  
AND  
TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The purpose of this specification is to establish the requirements and standards for surveys for public safety radio signal strength in buildings as required by the NFPA, IBC, IFC and local AHJ. This specification is only for a RF survey. If an existing ERRCES is on premise and is operational, provide verification and documentation of the existing ERRCES as specified.
1. This survey is required as part of the contract documents and shall be implemented as specified in this specification unless indicated or specified otherwise.
  2. This survey is required for in all buildings with basements, all buildings four stories and taller, and all buildings with an aggregate total building area of 50,000 square feet or more; this survey may still be required for other buildings that do not meet these structural requirements.
  3. This survey may not be required if the local AHJ has pre-determined that an Emergency Responder Radio Coverage Enhancement System (ERRCES) is not required for the subject building(s). If a survey is not required by the AHJ, notify the Architect, Engineer, Owner prior to scheduling the survey.
  4. The survey requirements specified in this section are intended to be slightly more stringent than minimum IBC and IFC requirements. This is to help mitigate radio coverage deficiencies that could be caused by future minor variations in building use configurations and changing atmospheric conditions.
- B. Where the subject building(s) do not have an existing ERRCES, this survey shall be for ERRC measurements and compliance evaluation only, it is not intended as a requirement for designing nor a requirement for providing an ERRCES.
- C. Where the subject building(s) have an existing and operational ERRCES, this survey shall include a full yearly functionality test of the existing ERRCES hardware, antennae, wave guides, cabling, wiring, and connectivity as required by the local AHJ, IBC, IFC, and NFPA. This survey shall then be able to be used for the required yearly inspection and testing report of the existing ERRCES. If deficiencies of an existing ERRCES are observed or detected during field signal measurement, the contractor shall document those deficiencies and report them to the Owner in writing within two Owner's business days of completion of the testing so that the Owner can take immediate remedial action. Corrections and modifications to existing ERRCES are not part of this specification section requirements.
- D. Technical information for this survey shall be obtained from the local AHJs pertaining the specific technical information and requirements for the emergency responder communications coverage system. This information shall include but not be limited to the various frequencies required, the location of radio antennae sites, the effective radiated power of the AHJ radio antennae sites, the maximum propagation delay in microseconds, the applications being used, and other supporting technical information that would be necessary for an ERRCES design and to fully test an existing ERRCES.
- E. Surveys for new construction shall be performed after the building is fully dried in, with interior wall construction and all exterior wall glazing completed, and prior to start of installation of electrical wiring. It is the intent that this survey be completed as soon as practical, results reported to the Owner and analyzed, and if required or specified as part of the contract documents or if it is to be provided by others, a radio antenna/repeater system can be designed, installed, fully operational, and commissioned without delaying the scheduled contract date for certificate of occupancy (CO) or the AHJs final inspection and approval for full Owner and public occupation of the building.

RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC)  
AND  
TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

- F. Conduct surveys using a RF Spectrum Analyzer, a calibrated system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required or that if existing, the existing ERRCES is functioning properly and providing the proper radio coverage. All test equipment shall have been calibrated within the previous 12-months of the date(s) of testing. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code. General weather conditions and time of day during the test shall be documented as part of the survey report.

## 1.2 SURVEY CRITERIA

- A. The required Public Safety Radio Signal Level inside the Owner's facility shall be as required by code, ordinance, AHJ, and as specified.
- B. Survey shall be performed by an FCC licensed technician holding a current General Radiotelephone Operator License (GROL). Where required by the local AHJ, the licensed operator shall be registered with the AHJ as an ERRC Special Inspector (or equivalent designation given by the AHJ) with in-building emergency radio system certification issued by a nationally recognized organization, school, or the emergency radio system manufacturer of the equipment being tested where an existing ERRCES is being tested, or certification by the ERRCES if a new ERRCES is specified elsewhere to be installed as part of the contract documents.

## 1.3 REGULATIONS

- A. Codes, regulations, and standards shall be the latest published standards. The latest national published standards listed below shall supersede any local standard unless doing so would violate the intent of the local code requirements.
  - 1. NFPA 1 – Fire Code
  - 2. NFPA 70 – National Electrical Code
  - 3. IFC 510- Emergency Responder Radio Coverage
  - 4. NFPA 101, Life Safety Code, and all local amendments and requirements.
  - 5. NFPA 72 National Fire Alarm and Signaling Code
  - 6. FCC 47 CFR Telecommunications
  - 7. FCC 47 CFR 90.219 Use of Signal Boosters
  - 8. IFC - International Fire Code
  - 9. Local or State Fire Codes
  - 10. ADA "Americans with Disabilities Act" and any local or state or local accessibility standards and amendments.
  - 11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
  - 12. FCC Rules Part 22 Public Mobile Services, Part 90 and Part 101
  - 13. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
  - 14. IBC - International Building Code
  - 15. UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems
  - 16. NFPA 3000 (PS) - Standard for an Active Shooter/Hostile Event Response (ASHER) Program and if present, Owner's specific ASHER Program. Note: Although currently considered by the NFPA as a Provisional Standard (PS), the issued NFPA 3000 shall be considered part of this specifications as if it were a fully accredited document to NFPA standards. If the building Owner has established an ASHER Program, it too shall be considered part of this specification section requirements.

## 1.4 DEFINITIONS

- A. Definitions:
  - 1. Area: A enclosed space in a building consisting floor to ceiling walls with doors.
  - 2. ASHER Program: Active Shooter Hostile Event Response Program. Program elements developed by the building's Owner to determine the necessary functions and actions

### RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC) AND TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

related to preparedness, response, and recovery from an active shooter/hostile event response.

3. BDA: Bi-Directional Amplifier. A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
4. BER: Bit Error Rate is the number of bit errors per unit time
5. DAS: Distributed Antenna System
6. ERRCES / ERRCS: Emergency Responder Radio Coverage Enhancement System / Emergency Responder Radio Coverage System. A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
7. FCC: Federal Communications Commission
8. Grid or test grid: The individual specified and/or code required imaginary spaces inside the building used for radio coverage testing. Typically a grid space consist of a square space with equal or almost equal side dimensions where the radio signal levels are measured at the center of each grid space to verify radio coverage. Grid spaces can consist of individual areas or rooms meeting the maximum size requirements.
9. GROL- FCC General Radiotelephone Operators License
10. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
11. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies. Typically, there may be multiple agencies for each type of responder, including those administered by the building Owner.
12. RSSI: Received signal strength indicator RSSI is a relative measurement of the power present in a received radio signal.
13. Zone: The individual partitioned grid specified and/or code required imaginary space(s) inside large buildings. Typically, each zone shall be no more than 50,000 square feet and shall be contiguous on the same building floor. Zones are further sub-divided into smaller grid spaces so that radio signal levels can be measured at the center of each grid space to verify radio coverage. A zone can be an individual wing of a building or separate floors of a building that do not exceed 50,000 square feet each. Zones can be created for separate test report areas to ensure individual grid test spaces are not excessive in physical area size and detrimental to the accuracy and resolution of the test data measurement point locations. Each zone must pass the radio coverage test for the entire building to pass the test. Zones can exceed 50,000 square feet as long as the maximum allowable grid space size is not exceeded.

## PART 3 – EXECUTION

### 3.1 EXECUTION

#### A. Testing Procedures and Parameters

1. The test shall be conducted using a calibrated portable radio authorized by the local AHJ, and of the latest brand and model used by the agency talking through the agency's radio communication system.
2. Testing shall include all critical areas required by the NFPA 1221 and others included in the list below. Critical areas shall be provided with a minimum 99-percent floor area radio coverage in each specific area. Critical areas include but are not limited to the following areas:
  - a. Fire command centers
  - b. Fire pump rooms
  - c. Exit stairs
  - d. Exit passageways
  - e. Elevator lobbies
  - f. Areas of rescue or refuge
  - g. Areas with or spaces adjacent to standpipe cabinets

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- h. Areas with or spaces adjacent to sprinkler sectional valve locations
  - i. Areas with or spaces adjacent to bleeding control kits.
  - j. Areas with or spaces adjacent to Automatic External Defibrillators (AEDs) for public use.
  - k. Areas designated for persons with special needs or areas for specifically designated for persons who are not ambulatory including those in wheelchairs but require physical assistance by others to evacuate the building.
  - l. Specific bullet resistant areas or spaces designated by the Owner or designated in the Owner's ASHER Program as a bullet resistant panic and safe room/areas or spaces.
  - m. Front lobby areas and/or building administrative areas with direct wired microphone or wired telephone handset access to the building's mass notification or building wide communication system when such system is existing or to be installed as part of this project.
  - n. Areas and/or building administrative areas with public safety radio base stations used for direct communications with Owner's police or security personnel.
  - o. Other areas deemed critical by the AHJ.
3. Testing grid spaces, areas, and zones shall be as required by the local AHJ and/or as specified in this specification. The more stringent requirements of the local code, AHJ, or those specified or indicated elsewhere in the contract documents shall apply. Specific requirement for the test grids, areas, and zones shall be follows:
- a. Testing shall be based on a minimum of 20 approximately equal size grid spaces per floor or zone with a maximum of 2,500 square foot per test space. Failure of more than one test space shall be considered a test failure.
  - b. In the event that only two test spaces fail the 20-space grid test above, the same floor/zone shall be divided into 40 approximately equal size grid spaces or a maximum of 1,250 square feet per space and re-tested. Failure of only one or only two nonadjacent test spaces on that floor or zone shall result in a non-failure for that floor or zone. Failure of three or more spaces shall result in a test failure for that floor or zone. Failure of two adjacent test spaces shall result in a test failure of that floor or zone.
4. If there is an existing ERRCES and there are grid space test failures resulting in a failed test, notify the Owner in writing immediately about the failed spaces after the completed test and identify the specific areas of the building that are not compliant. The final test result formal submittal data may be submitted at a later date as specified. Contractor may provide recommendations for alterations or modifications to the existing system to the Owner/Architect/Engineer so that the deficiencies can be addressed by the Owner as soon as possible and corrective measures taken by the Owner. Make corrective measures or modifications to the existing system only if specifically instructed by the Owner in writing.
5. Two-way radio communications shall be verified by testing the two-way communication to and from the outside of the building from a single point approximately at the center of each test grid space or room area. Retesting from a different point inside the same grid space or room area is prohibited if the first point selected fails the test. The initial failure shall be recorded as a failed test grid space or area.
6. Signal strength for a non-failure shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as required by the AHJ.
7. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The inbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
- 8.. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The outbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.

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9. Buildings with existing ERRCES: Verify the following, include the requested information report deficiencies to the Owner as part of the ERRC report.
  - a. Verify the existing ERRCES is fully monitored by the building fire alarm system as required by NFPA 1221 and NFPA 72.
  - b. If there is an existing remote ERRCES annunciator, verify all annunciators and indicators required by NFPA 1221 are operational and functioning properly.
  - c. The gain values of all existing ERRCES amplifiers shall be measured and documented for comparison for future annual testing of the ERRCES.
  - d. A spectrum analyzer or other suitable test equipment shall be used to verify spurious oscillations are not being generated by existing signal booster(s).
  - e. Verify that the isolation between the donor antenna and all inside antennas is maintained to a minimum of 20dB above system gain.

### 3.2 SURVEY REPORT SUBMITTALS

- A. Submit summary findings and detailed test report data within 14-days of notice to proceed.
- B. Buildings not in compliance with the ERRC testing: Indicate areas of the building deficient in ERRC. Provide general recommendations of the necessary equipment and means required to bring the building into full ERRC compliance for Owner review in the summary findings. This specification section is only intended for survey, report, and recommendation information only and is not intended for detailed design, modification, or corrective measures. The report data submittal shall be complete in such that it would be useful to assist in a detailed design of a ERRCES. Submit additional report data as indicated below.
- C. Building in compliance with required ERRC: Include a copy of the inspection report to be issued to the AHJ(s) in the format required by the AHJ(s) and submit the report to the AHJ(s) as part of the building permitting process.
- D. Report data submittals shall include but are not be limited the following:
  1. Include a copy of survey contractor's AHJ and FCC required licenses to perform the survey.
  2. Where there is an existing ERRCES, include an updated ERRCES technical document and yearly report which the Owner shall keep on file as required by NFPA 1221. Technical documents shall in include but may not be limited to the following information typically provided by the AHJ(s):
    - a. Frequencies required by the AHJ(s) for the existing in-building enhancement system (EERCES).
    - b. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system (ERRCES).
    - c. Maximum propagation delay in microseconds.
    - d. List of specifically approved ERRCES components.
    - e. Other supporting technical information necessary for the existing system maintenance, or future modifications.
  3. Confirmation that the ERRC for the building that is subject of the report has been determined to meet the minimum coverage requirement as defined by the IBC/IFC, this survey specification section's requirements, and the local AHJ requirements.
  4. Include a scaled drawing of the building with RF measurements of each floor or zone of the building which indicates relative RF field strength for each frequency band of interest. Minimum drawing size 11x17-inch, maximum 30x42-inch.
  5. The drawings shall indicate clearly the areas that have passed or failed based on the more restrictive of the above parameters or those specifically required by the AHJ.
  6. When required by the AHJ, inspection reports by AHJ approved third-party inspector in the format required by the AHJ.

END OF SECTION

RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC)  
AND  
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SECTION 31 00 00

EARTHWORK

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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 recompact 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 T 99.
- 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 T 99.

### 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 not 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

SECTION 31 06 20.15

CEMENT STABILIZED SAND

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cement stabilized sand.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No payment will be made for cement stabilized sand under this Section unless specifically noted in bid documents. Include payment for cement stabilized sand in unit price for applicable utility or structure installation section.
- B. 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.

- B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

## 1.5 DESIGN REQUIREMENTS

- A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.
  - 1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
  - 2. Determine minimum cement content from production data and statistical history. Provide no less than 1.5 sacks of cement per ton of dry sand.

## PART 2 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:  $f'c\% \pm 1/2$  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 stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test 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
  - 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 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

SECTION 31 06 20.17

UTILITY BACKFILL MATERIALS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. No payment will be made for backfill material unless specifically listed in the bid documents. Include payment in unit price for applicable utility installation.
- B. 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

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SECTION 31 11 00

CLEARING AND GRUBBING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. Payment for clearing and grubbing is on a per Acre basis.
- B. 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 top soil scheduled for reuse.
- 3.4 REMOVAL
- A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Division 1.
  - B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

SECTION 31 22 00

GRADING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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 that remain.
- B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.
- C. Protect bench marks survey, control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil - Soil Type: Topsoil excavated on-site.
  - 1. Graded.
    - a. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
    - b. Provide imported topsoil conforming to the requirements of Division 32 as required.
  - 2. Other Fill Materials: Reference relevant sections of Division 32 and the Drawings.

PART 3 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

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SECTION 31 23 00

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Excavation, backfilling, and compaction of backfill for structures.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices.

1. No payment will be made for structural excavation and backfill under this Section. Include payment in unit price or lump sum for construction of structures.
2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

- A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

- B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.

- C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.

- D. Backfill: Material meeting specified quality requirements, placed and compacted under controlled conditions around structures.

- E. 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.

- F. Foundation Base: For foundation base material, use 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.

- G. Foundation Subgrade: Foundation subgrade is surface of natural soil which has been excavated and prepared to support foundation base or foundation backfill, where needed.

- H. Ground Water Control Systems: Installations external to excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which

would otherwise emerge from side or bottom of excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

- I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from excavation. Remove rain water and surface water which accidentally enters excavation as part of excavation drainage.
- J. Excavation Drainage: Removal of surface and seepage water in excavation by sump pumping and using French drains surrounding foundation to intercept water.
- K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below foundation as shown on Drawings, and backfilled with foundation backfill material.
- L. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins.

#### 1.4 REFERENCES

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600kN-m/m<sup>3</sup>)).
- B. ASTM D 1556 - Standard Test Method for Density of Soil in Place by Sand-Cone Method.
- C. ASTM D 2922 - Standard Test Methods for Density of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- D. ASTM D 3017 - Standard Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).
- E. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- F. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
- G. TxDOT Tex-110-E - Particle Size Analysis of Soils.
- H. Federal Regulations, 29 CFR, Part 1926, Standards - Excavation, Occupational Safety and Health Administration (OSHA).

#### 1.5 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit work plan for excavation and backfill for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to excavation and backfill activities. Use descriptions, with supporting illustrations, sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Drawings.
- C. Submit excavation safety system plan.
  - 1. Submit excavation safety system plan in accordance with applicable OSHA requirements for excavations.
  - 2. Submit excavation safety system plan in accordance with requirements of Section 02260 - Trench Safety System, for excavations that fall under State and Federal trench safety laws.
- D. Submit ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

- E. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.
- F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.6 TESTS

- A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.
- B. Perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

PART 2 P R O D U C T S

2.1 EQUIPMENT

- A. Perform excavation with equipment suitable for achieving requirements of this Specification.
- B. Use equipment which will produce degree of compaction specified. Compact backfill within 3 feet of walls with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to depth of fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.2 MATERIAL CLASSIFICATIONS

- A. Use backfill materials conforming to classifications and product descriptions of Section 02320 - Utility Backfill Materials. Use classification or product description for backfill applications as shown on Drawings and as specified.

PART 3 E X E C U T I O N

3.1 PREPARATION

- A. Conduct an inspection to determine condition of existing structures and other permanent installations.
- B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where construction work is considered hazardous to traffic movements.
- C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 02260 - Trench Safety Systems.
- D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.
- E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.2 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.
- B. Protect and support above-grade and below-grade utilities which are to remain.



- C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.
- D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.
- E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to City.

### 3.3 EXCAVATION

- A. Perform excavation work so that underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Project Manager.
- B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding in such areas.
- C. Immediately notify agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.
- D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.
- E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.
- F. Conduct hauling operations so that trucks and other vehicles do not create dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner such that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.
- G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by Work.
- H. Provide sheeting, shoring, and bracing where required to safely complete Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect Work and adjacent structures or improvements. Use sheeting, shoring, and bracing to protect workmen and public conforming to requirements of Section 02260 - Trench Safety Systems.
- I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, cement stabilized sand, or other material approved by Project Manager and compact to 95 percent standard density.
- J. After completion of structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Project Manager in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to Work and adjacent structures or improvements.
- K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or other material approved by Project Manager and compact to 95 percent standard density.

### 3.4 HANDLING EXCAVATED MATERIALS

- A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at sufficient distance from excavation to prevent slides or cave-ins.

- B. Provide additional backfill material in accordance with requirements of Section 02319 - Borrow, if adequate quantities of suitable material are not available from excavation and trenching operations at site.

### 3.5 DEWATERING

- A. Provide ground water control per Section 01 57 23.12 - Control of Ground Water and Surface Water.
- B. Keep ground water surface elevation minimum of 2 feet below bottom of foundation base.
- C. Maintain ground water control as directed by Section 01 57 23.12 - Control of Ground Water and Surface Water and until structure is sufficiently complete to provide required weight to resist hydrostatic uplift with minimum safety factor of 1.2.

### 3.6 FOUNDATION EXCAVATION

- A. Notify Project Manager at least 48 hours prior to planned completion of foundation excavations. Do not place foundation base until excavation is accepted by Project Manager.
- B. Excavate to elevations shown on Drawings, as needed to provide space for foundation base, forming level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or material as directed by Project Manager. Prior to placing material over it, recompact subgrade where indicated on Drawings, scarifying as needed, to 95 percent of maximum Standard Dry Density according to ASTM D 698. If specified level of compaction cannot be achieved, moisture condition subgrade and recompact until 95 percent is achieved, over-excavate to provide minimum layer of 24 inches of foundation backfill material, or other means acceptable to Project Manager.
- C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by Project Manager.
- D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement. E. Remove soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to required subgrade, and replace with foundation backfill material, as directed by Project Manager, at no additional cost to City.
- E. Place foundation base, or foundation backfill material where needed, over subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with seal slab or cement-stabilized sand.
- F. Use filter fabric as specified in Section 02621 - Geotextile to separate crushed aggregate, and other free draining Class I materials from native soils or select material backfill. Overlap fabric minimum of 12 inches beyond where another material stops contact with soil. H. Place crushed aggregate, and other Class I materials, in uniform layers of 8-inch maximum thickness. Perform compaction by means of at least two passes of vibratory compactor.

### 3.7 FOUNDATION BASE.

- A. Place foundation base after subgrade is properly prepared, including placement of foundation backfill where needed. Use foundation base consisting of 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, seal slab with minimum thickness of 4 inches may be placed. Extend foundation base minimum of 12 inches beyond edge of structure foundation, unless shown otherwise on Drawings.
- B. Where foundation base and foundation backfill are of same material, both can be placed in one operation.

3.8 BACKFILL

- A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Remove forms, lumber, trash and debris from structures. Deposit backfill in uniform layers and compact each layer as specified.
  - 1. Unless otherwise shown on Drawings, for structures under pavement or within one foot back of curb, use cement stabilized sand up to the top of the proposed structure. Use suitable on-site material (random backfill) up to 12 inches below pavement base or subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.
  - 2. Unless otherwise shown on Drawings, for structures not under pavement, use random backfill of suitable material up to the surface.
- B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that concrete has reached minimum of 85 percent of specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until slab or intermediate walls have been placed and concrete has attained sufficient strength.
- C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.
- D. Maintain backfill material at no less than 2 percent below nor more than 2 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698 below paved areas. Compact fill to at least 90 percent around structures below unpaved areas.
- E. Where backfill is placed against sloped excavation surface, run compaction equipment across boundary of cut slope and backfill to form compacted slope surface for placement of next layer of backfill.
- F. Place backfill using cement stabilized sand in accordance with Section 02321 – Cement Stabilized Sand.

3.9 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.
- B. Tests will be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity.
- C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions:
  - 1. Minimum of one test for every 50 to 100 cubic yards of compacted backfill material as directed by Project Manager.
  - 2. A minimum of three density tests for each full work shift.
  - 3. Density tests will be performed in all placement areas.
  - 4. Number of tests will be increased when inspection determines that soil types or moisture contents are not uniform or when compacting effort is variable and not considered sufficient to attain uniform density.
  - 5. Identify elevation of test with respect to natural ground.
  - 6. Record approximate depth of lift tested.
- D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Perform additional moisture-density relationship test once a

month or whenever there is noticeable change in material gradation or plasticity.

- E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

Dispose of excess materials in accordance with requirements of Section 01576 – Waste Material Disposal.

END OF SECTION

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SECTION 31 23 16.14

TRENCH SAFETY SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Trench Safety System for the construction of trench excavations.
- B. Trench Safety System for structural excavations that fall under provisions of State and Federal trench safety laws.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for Trench Safety is on a Linear Foot Basis.
- B. Stipulated Price (Lump Sum). The Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 DEFINITIONS

- A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.
- B. The Trench Safety System requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and the installation to dimensions equivalent of a trench as defined.
- C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

1.4 SUBMITTALS

- A. Submittals shall conform to requirements of Division 1.
- B. Submit a safety program specifically for the construction of trench excavation. Design the Trench Safety Program to be in accordance with OSHA 29 CFR standards governing the presence and activities of individuals working in and around trench excavations.
- C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by Contractor.
- D. Review of the safety program by the Engineer will only be in regard to compliance with this specification and will not constitute approval by the Engineer nor relieve Contractor of obligations under State and Federal trench safety laws.

1.5 REGULATORY REQUIREMENTS

- A. Install and maintain Trench Safety Systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

- B. The Contractor is responsible for obtaining a copy of OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209.
- C. Legislation that has been enacted by the Texas Legislature with regard to trench safety systems is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., § 756.021 (Vernon 1991).
- D. Reference materials, if developed for a specific project, will be issued with the Bid Documents.

#### 1.6 INDEMNIFICATION

- A. Contractor shall indemnify and hold harmless the Owner, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.
- B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

#### PART 2 PRODUCTS – Not Used

#### PART 3 EXECUTION

##### 3.1 INSTALLATION

- A. Install and maintain Trench Safety Systems in accordance with provisions of OSHA 29 CFR.
- B. Install specially designed Trench Safety Systems in accordance with the Contractor's trench excavation safety program for the locations and conditions identified in the program.
- C. A competent person, as identified in the Contractor's trench safety program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

##### 3.2 INSPECTION

- A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the Trench Safety Systems to ensure that the installed systems and operations meet OSHA 29 CFR and other personnel protection regulations requirements.
- B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until necessary precautions have been taken by Contractor to safeguard personnel entering the trench.
- C. Maintain a permanent record of daily inspections.

##### 3.3 FIELD QUALITY CONTROL

- A. Contractor shall verify specific applicability of the selected or specially designed Trench Safety Systems to each field condition encountered on the project.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.2 MEASUREMENT AND PAYMENT

- A. 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. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.
- B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
- C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.
- D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.
- E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.
- F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.
- G. Unsuitable Material: Unsuitable soil materials are the following:
  - 1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
  - 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
  - 3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
  - 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.
- I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.
- J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Division 1.



- K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.
- L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.
- M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.
  - 1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
  - 2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
    - a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
    - b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.
    - c. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.
- N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.
- O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.
- P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.
- Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.
- R. Trench Safety Systems include both protective systems and shoring systems as defined in Division 31.
- S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.
- T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.
- U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

#### 1.4 REFERENCES

- A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.
- B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

- C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).
- D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.
- G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
- K. TxDOT Tex-110-E - Particle Size Analysis of Soils.
- L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

#### 1.5 SCHEDULING

- A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

#### 1.6 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit planned typical method of excavation, backfill placement and compaction including:
  - 1. Trench widths.
  - 2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.
  - 3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.
- C. Notify owner prior to beginning trenching work and allow sufficient time for owner to locate area.
- D. Submit backfill material sources and product quality information in accordance with requirements of Division 31.
- E. Submit trench excavation safety program in accordance with requirements of Division 31. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.
- F. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.
- G. Submit 11 inch by 17 inch or 12 inch by 18 inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Owner's Representative.

#### 1.7 TESTS

- A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by Owner in accordance with requirements of Division 1 and as specified in this Section.
- B. Perform backfill material source qualification testing in accordance with requirements of Division 31.

#### 1.8 SPECIAL SHORING DESIGN REQUIREMENTS

- A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT

- A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.
- B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.
- C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.
- D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

#### 2.2 MATERIAL CLASSIFICATIONS

- A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Division 31.
- B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Division 31.
- C. Geotextile (Filter Fabric): Conform to requirements of Division 1.
- D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.
- E. Timber Shoring Left in Place: Untreated oak.

### PART 3 EXECUTION

#### 3.1 STANDARD PRACTICE

- A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.
- B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.
- C. Classification of material will be determined by Owner's Representative.

#### 3.2 PREPARATION

- A. Establish traffic control to conform to requirements of Division 1. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.
- B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Division 31.
- C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Owner's Representative and agency for any repairs or relocations, either temporary or permanent.
- D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Division 2, as applicable.
- E. Install and operate necessary dewatering and surface-water control measures to conform to Division 1. Provide stable trench to allow installation in accordance with Specifications.
- F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Division 1.

### 3.3 CRITICAL LOCATION INVESTIGATION

- A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2 feet vertically and 4 feet horizontally of proposed work.
  - 1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.
  - 2. Notify Owner's Representative in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Owner's Representative is notified of obstruction.
- B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Owner's Representative with 48 hours notice prior to field excavation or related work.
- C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12 inch by 18 inch copy of Drawings. For large diameter water lines, submit to Owner's Representative for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

### 3.4 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Division 1.
- B. Protect and support above-grade and below-grade utilities which are to remain.
- C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.
- D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to the Owner.

### 3.5 EXCAVATION

- A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.
- B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
- C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.).

<b>Nominal Pipe Size, Inches</b>	<b>Minimum Trench Width, Inches</b>
Less than 18	O.D. + 24
18 to 30	O.D. + 24
36 to 42	O.D. + 36
<u>Greater than 42</u>	<u>O.D. + 48</u>

- D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.
- E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Owner's Representative and obtain instructions before proceeding.
- F. Shoring of Trench Walls.
  - 1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.
  - 2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
  - 3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Owner's Representative. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
  - 4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
  - 5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.
- G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
  2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.
  3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
  4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.
  5. Conform to applicable Government regulations.
- H. Voids under or damages to paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports. Contractor is responsible for all cost associated with the repairs.
- I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.
- J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.
- K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy-acetylene weld is exposed, immediately notify Owner's Representative. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

### 3.6 HANDLING EXCAVATED MATERIALS

- A. Use only excavated materials, which are suitable as defined in this Section and conforming to Division 31. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.
- B. When required, provide additional backfill material conforming to requirements of Division 31.
- C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Division 1. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

### 3.7 TRENCH FOUNDATION

- A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.
- B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6 inches with approval by Owner's Representative. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

- C. Perform over excavation, if directed by Owner's Representative, in accordance with Paragraph 3.07B above. Removal of unstable or unsuitable material may be required if approved by Owner's Representative:
  - 1. Even though Contractor has not determined material to be unsuitable, or
  - 2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Division 1.
- D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

### 3.8 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

- A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.
- B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.
- C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.
- D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.
- E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.
- F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.
- G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.
- H. Place electrical conduit, if used, directly on foundation without bedding.
- I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.
- J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Division 31. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:
  - 1. Class I, II and III Embedment Materials:
    - a. Maximum 6 inches compacted lift thickness.
    - b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
    - c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Owner's Representative.
  - 2. Cement Stabilized Sand (where required for special installations):
    - a. Maximum 6 inches compacted thickness.
    - b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
    - c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
  - 3. Class I Embedment Materials.
    - a. Maximum 6-inches compacted lift thickness.

- b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
    - c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.
  - 4. Class II Embedment and Cement Stabilized Sand.
    - a. Maximum 6-inches compacted thickness.
    - b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
    - c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.
- K. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

### 3.9 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

- A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.
- B. For water lines, backfill in trench zone, including auger pits, intermediate and site pits, with bank run sand, select fill, or random backfill material as specified in Division 31.
- C. For sewer pipes, use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand to level 12 inches below the pavement. For sewer pipes under natural ground backfill from 12 inches above top of pipe to 6" inches below finish grade with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement. Use topsoil for 6-inch backfill directly under natural grade. For backfill materials reference Division 31.
- D. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.
- E. When shown on Drawings, random backfill of suitable material may be used in trench zone for trench excavations outside pavements.
- F. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.
  - 1. Class I, II, III or IV or combination thereof (Random Backfill):
    - a. Maximum 9-inches compacted lift thickness.
    - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
    - c. Moisture content within zero percent to +5 percent of optimum determined according to ASTM D 698, unless otherwise approved by Owner's Representative.
  - 2. Cement-Stabilized Sand:
    - a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.
    - b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
    - c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.
  - 3. Select Backfill:
    - a. Place in maximum 8-inch loose layers.
    - b. Compaction by equipment providing tamping or kneading impact to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
    - c. Moisture content within 2 percent below or 5 percent above optimum determined according to ASTM D 698, unless approved by Owner's Representative.



- G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone.
  - 1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at no additional cost to Owner, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.
  - 2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
  - 3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
  - 4. Moisture content as necessary to achieve density.
- H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

### 3.10 MANHOLES, INLETS, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

- A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.
- B. Below paved areas, encapsulate structure with cement stabilized sand; minimum of 1 foot below base, minimum 2 foot around walls, up to within 12 inches of pavement subgrade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement.
- C. In unpaved areas, encapsulate structure with cement stabilized sand; minimum of 1 foot below base, minimum 2 foot around walls, up to within 12 inches of finish grade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use suitable on-site material and topsoil for the 12-inch backfill directly under natural ground.

### 3.11 FIELD QUALITY CONTROL.

- A. Test for material source qualifications as defined in Division 1.
- B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.
- C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Owner's Representative.
- D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.
- E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.
  - 1. For open cut construction projects and auger pits: Unless otherwise approved by Owner's Representative, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.
  - 2. A minimum of three density tests for each full shift of Work.
  - 3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.
  5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
  6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
  7. Recompacted placement will be retested at same frequency as first test series, including verification tests.
  8. Identify elevation of test with respect to natural ground or pavement.
- F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.
- G. Acceptability of crushed rock compaction will be determined by inspection.
- 3.12 DISPOSAL OF EXCESS MATERIAL
- A. Dispose of excess materials in accordance with requirements of Division 1.

END OF SECTION 31 23 33

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SECTION 31 31 00

SOIL TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Application of soil chemicals for the prevention of termite infestation.

B. Related Sections:

1. **[Section 07 26 00 - Vapor Retarders ]**

1.2 SUBMITTALS

A. Product Data: For termiticide.

1. Include the current EPA-Registered Label for termiticide products.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Work shall be performed by a licensed, reputable, pest control operator with an established record of at least five years successful experience in this work.

B. Regulatory Requirements: Application of soil treatment shall meet the requirements of regulatory organizations.

1. Texas Department of Agriculture, Structural Pest Control Service, Austin, TX.
2. Formulate and apply termiticides according to the EPA-Registered Label.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-registered label.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard from, signed by application and contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites for a period of 5 years from date of substantial completion. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.1 2.1 SOIL TREATMENT SOLUTION

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of Texas Department of Agriculture, Structural Pest Control Service, Austin, TX, in an aqueous solution formulated to prevent termite infestation. Solution shall include synthetic dye to permit visual identification of treated soil. Product/manufacturer; one of the following:

Demon MAX; Syngenta

BaseLine™ or Dragnet SFR; FMC Corp., Agricultural Products Group

B. Dilute termiticide as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION/PREPARATION

A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb termiticide, ready to receive treatment.

B. Beginning of application means acceptance of soil conditions.

- C. Notify Architect and Owner at least 12 hours prior to beginning work.

### 3.2 APPLICATION

- A. Apply termiticide to soil at metered rates, in accordance with manufacturer's instructions or as indicated below if more stringent.
- B. Applying Chemicals: Apply the solution not more than 24 hours prior to placing concrete slabs and at such time as there is reasonable assurance that no rain will fall until after the slabs have been placed.

**\*\*\* STRUCTURAL SUSPENDED SLAB OVER CRAWLSPACE = USE ONLY "1. VERTICAL BARRIER"**

**\*\*\* STRUCTURAL SLAB ON CARTON FORMS OR SLAB-ON-GRADE = USE "1. AND 2."**

1. Vertical Barrier:
  - a. Establish a vertical barrier in areas around the base of footings, foundation walls, grade beams, plumbing, piers, and backfill soil. Treat both sides of footings, walls, beams, and around all sides of pipes and piers.
  - b. Apply at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of footings or the bottom of beams as each demands.
  - c. Applications must be made by rodding and/or trenching in accordance with manufacturer's application instructions.
  - d. Cover the treated soil with a thin layer of untreated soil or other suitable barrier such as polyethylene sheeting.
  - e. Apply extra treatment to structure penetrations, pipe, ducts, expansion joints and other soil penetrations.
2. Horizontal Barrier:
  - a. Establish a horizontal barrier under concrete slabs on carton forms. Apply emulsion at the rate of 1 gallon per 10 square feet of grade.
  - b. Applications shall be made by a low pressure spray.
  - c. If concrete slab cannot be poured over the soil the same day it has been treated, cover treated soil immediately after application with polyethylene sheeting (Section 07 26 00 - Vapor Retarders) to prevent disturbance of the termiticide barrier. **This protective vapor retarder shall be removed prior to the placement of void boxes. Vapor retarder will be placed on top of the void boxes. If slab-on-grade is used, do not remove vapor retarder**

**(If slab-on-grade is used, do not remove vapor retarder and delete above.)**

- C. Post signs in the areas of application warning workers that soil poisoning has been applied. Signs shall remain in place until areas are covered by other construction.

END OF SECTION

**SECTION 31 63 29  
DRILLED CONCRETE PIERS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Labor and materials required to construct drilled concrete piers complete including layout, excavation of shafts, temporary steel casings, fabrication and installation of reinforcing steel, furnishing and placing concrete, setting anchor bolts, embedded base plates and removal of spoils.

**1.2 RELATED SECTIONS**

- A. Division 3 Sections: For general structural and building applications of concrete.

**1.3 REFERENCES**

- A. American Concrete Institute (ACI)
  - 1. 336.1, Reference Specifications for the Construction of Drilled Piers

**1.4 QUALITY ASSURANCE**

- A. Where standards or requirements of this Section are in conflict with those noted on the Contract Drawings or the Building Code, the more stringent requirements shall govern. Bring all conflicts and discrepancies to the attention of the Architect and do not start work until such conflicts and discrepancies are clarified and corrected. Failure to do so will not relieve the Contractor from performing the Work correctly at no additional expense to the Owner.
- B. Installer Qualification: Company specializing in performing the work of this Section with minimum three projects in similar soil and rock conditions, and with similar shaft sizes, depths, and quantities.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
  - 1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

**1.5 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Submittals for Review:
  - 1. Shop Drawings: For concrete reinforcement detailing fabricating, bending, and placing.
  - 2. Shop Drawings: Indicate dimensioned plan layout, embed plates, dowel and anchor bolt setting plans including templates, drilled pier shaft sizes, casing sizes, and top elevation.
  - 3. Design Mixes: Refer to Specification Section 03 30 00.
- C. Submittals for Information:

1. Pier Drilling Log: Report of drilled concrete pier construction including actual elevations of top and bottom of each pier, elevation of bearing stratum, penetration into bearing stratum, deviations of pier centerline and plumbness, shaft size, presence of water, use of temporary casing, placement of concrete, and time of start and finish of excavation.
2. Welding certificates: Copies of Certificates for welding procedures and personnel.

## **1.6 UNIT PRICES**

- A. Base bids on indicated number and length of drilled piers; design length for each pier, determined from top elevation to bottom of shaft; and diameter of shaft . Provide unit prices as follows:
  1. Unit prices per linear foot for piers longer or shorter than base lengths.
  2. Unit prices per linear foot for casing. Measurement for payment shall be from top of pier to top of bearing stratum.
- B. The cost of casings shall be included in the base price for straight shaft piers. If casings are not used, the Contract shall be adjusted based on the unit price.
- C. Basis for Payment:
  1. Unit prices include labor, materials, overhead and fees, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, and other items for complete drilled-pier installation.
  2. Payment for drilled piers will be made on actual net linear feet of drilled piers in place and approved. Actual length, shaft diameter may vary to coincide with elevations where satisfactory bearing strata are encountered.
  3. Adjustments to the Contract shall be based on total linear feet greater than or less than the sum of the base lengths of each pier size. Additional penetration in the specified bearing stratum greater than the specified penetration shall not be included in determination of increases or decreases of pier lengths related to adjustments in the Contract.

## **1.7 PROJECT CONDITIONS**

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
  1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Site Information: A geotechnical report has been prepared for this Project and is available for information only.
  1. Information regarding site conditions is provided for the convenience of the Contractor and is not a warranty that the information represents site conditions that may be encountered. The Owner shall not be responsible for interpretations or conclusions drawn from the information provided by the Contractor.
  2. Additional borings or other exploratory work may be conducted by the Contractor at no cost to the Owner.

## **PART 2 - PRODUCTS**

### **2.1 STEEL REINFORCEMENT**

- A. Refer to Section 03 20 00 for steel reinforcement materials and fabrication.
- B. Bar Supports: Furnish spacers to maintain required concrete cover to sides and bottom of excavation.
  - 1. Shaftspacer Systems, Foundation Technologies, Inc., Tucker, Georgia
  - 2. "Centraligner" and "Hijacker", Pieresearch, Arlington, Texas.

### **2.2 CONCRETE MATERIALS**

- A. Refer to Section 03 30 00 for concrete materials, concrete mix designs, and production and delivery.

### **2.3 ANCHOR BOLTS**

- A. Refer to Section of trade requiring anchor bolts.

### **2.4 STEEL CASINGS**

- A. Steel Pipe Casings: ASTM A 283, Grade C; or ASTM A36/A36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.
- B. Inspect locations and existing conditions under which drilled pier work is to be performed. Notify Contractor and Architect of any perceived unsatisfactory conditions.

### **3.2 EXCAVATION**

- A. Excavate shafts for drilled piers to the bearing strata indicated in the drawings.
- B. Excavate into the bearing strata the required penetrations shown in the drawings.
  - 1. Sides of the excavation in the bearing strata must be clean to develop the side shear capacity of the pier.
- C. Obstructions: Removal of unanticipated boulders, concrete, masonry, or other unforeseen obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or under reaming tools attached to drilling equipment of size, power, torque, and down thrust necessary for the Work, will be paid according to Contract provisions for changes in the Work.
- D. Clean bottom of each shaft before concreting.
- E. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.



- F. Remove water from excavated shafts before concreting.
- G. Excavate shafts for closely spaced drilled piers only after adjacent drilled piers are filled with concrete and allowed to set for a minimum of 24 hours.
- H. Temporary Casings: If flowing water or caving soil is encountered, install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls. Temporary steel casing may be left in place or removed during concrete placement at the Contractor's option. Required penetration in the bearing strata shall be below the bottom of any temporary casing.
- I. Tolerances:
  - 1. Construct drilled piers to remain within ACI 336.1 tolerances.
    - a. Maximum Variation From Vertical: One percent of length.
    - b. Maximum Variation From Design Top Elevation: Plus 1 inch to minus 3 inches.
    - c. Maximum Out-of-Position: One twenty-fourth of the shaft diameter or 3 inches, whichever is less.
  - 2. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.
- J. Inspection: Each drilled pier must be inspected and tested by Owner's testing and inspecting agency before placing concrete.
  - 1. Provide and maintain facilities with equipment required for testing and inspecting excavations. Cooperate with testing and inspecting personnel to expedite the Work.
  - 2. Notify Architect and testing agency at least six hours before excavations are ready for tests and inspections.
  - 3. Refer to Section 01 45 23 for Testing and Inspection Services.

### **3.3 STEEL REINFORCEMENT**

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover to reinforcement.
- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

### 3.4 CONCRETE PLACEMENT

- A. Place concrete immediately after delivery, in a continuous operation, without segregation, immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency, and within the time limit provided in the drawings.
  - 1. Construct a construction joint if concrete placement is delayed more than one (1) hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
  - 1. Where concrete cannot be directed down shaft without striking reinforcing, place concrete with chutes, tremies, or pumps.
  - 2. Vibrate top 60 inches of concrete.
- C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
  - 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- D. Remove excess concrete at top of pier and screed concrete at cutoff elevation level and apply scoured, rough finish. The top of the pier must be the same diameter as pier below. Where cutoff elevation is above the ground elevation, form top section above grade the same diameter as the pier below and extend shaft to required elevation.
- E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
  - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- F. When hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no greater than 95 degrees F.
  - 1. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

### 3.5 DISPOSAL OF MATERIALS

- A. Remove surplus excavated material and slurry and legally dispose of it off Owner's property.

**END OF SECTION**

SAMPLE WORKSHEET "I"  
PIER DEPTH RECONCILIATION WORKSHEET

PROJECT \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

PIER DIAMETER THIS PAGE \_\_\_\_\_

		A	MINUS	B	=	C	x	D	=	E
	PIER NO.	ESTIMATED BEARING ELEVATION		ACTUAL BEARING ELEVATION		AMOUNT DEEPER (+) OR SHALLOWER (-) THAN ESTIMATED BEARING		APPLICABLE UNIT PRICE FROM BID FORM (NOTE: EXTRA(+) OR CREDIT (-))		NET EXTRA COST OR CREDIT DUE PER PIER
1										
2										
3										
4										
5										
6										
7										
8										
9										

		A	MINUS	B	=	C	x	D	=	E
	PIER NO.	ESTIMATED BEARING ELEVATION		ACTUAL BEARING ELEVATION		AMOUNT DEEPER (+) OR SHALLOWER (-) THAN ESTIMATED BEARING		APPLICABLE UNIT PRICE FROM BID FORM (NOTE: EXTRA(+) OR CREDIT (-))		NET EXTRA COST OR CREDIT DUE PER PIER
										TOTAL OF COLUMN "E"

## SAMPLE WORKSHEET "II"

### PIER CASING LENGTH RECONCILIATION WORKSHEET

PROJECT \_\_\_\_\_

PAGE \_\_\_\_\_ OF \_\_\_\_\_

PIER DIAMETER THIS PAGE \_\_\_\_\_

		F	MINUS	A	=	G	F	MINUS	B	=	H
	PIER NO.	GROUND ELEVATION AT PIER		ESTIMATED BEARING ELEVATION		ESTIMATED CASING LENGTH	GROUND ELEVATION AT PIER		* ACTUAL BEARING ELEVATION		ACTUAL CASING LENGTH
1											
2											
3											

	<div>SUM OF FIGURES IN COLUMN "G"  x SPECIFIED BID BASIS PERCENTAGE FOR PIERS TO BE CASED  = TOTAL ESTIMATED CASING LENGTH</div>		<div>SUM OF FIGURES IN COLUMN "H"          = TOTAL ACTUAL CASING LENGTH</div>
--	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--	-------------------------------------------------------------------------------------------------------------------------------------------

TOTAL ACTUAL CASING LENGTH - TOTAL ESTIMATED CASING LENGTH x APPLICABLE UNIT PRICE EXTRA(+) OR CREDIT(-) = TOTAL COST OF CASINGS

TOTAL COLUMN "E" ON WORKSHEET "I" + TOTAL COST OF CASINGS ON WORKSHEET "II" = TOTAL DOLLAR CHANGE TO CONTRACT

\* IF THE ELEVATION OF THE BOTTOM OF CASING DIFFERS FROM THE ACTUAL BEARING ELEVATION, USE BOTTOM OF CASING ELEVATION WHEN CALCULATING TOTAL ACTUAL CASINGS.

## **SAMPLE "III"**

### **GLOSSARY OF TERMS USED IN SAMPLE WORKSHEETS "I" AND "II"**

#### **COLUMN "A" - ESTIMATED BEARING ELEVATION:**

For bidding purposes, it is the estimated elevation shown on the typical pier detail in the structural drawings at which point pier penetration commences.

#### **COLUMN "B" - ACTUAL BEARING ELEVATION:**

Actual elevation at which the bearing material is encountered by each pier as determined in the field by the independent testing laboratory.

#### **COLUMN "C" - AMOUNT DEEPER (+) OR SHALLOWER (-) THAN ESTIMATED BEARING ELEVATION:**

The amount, in feet, the bearing material was encountered above or below the estimated bearing elevation.

#### **COLUMN "D" - APPLICABLE UNIT PRICE FROM BID FORM, EXTRA (+) OR CREDIT (-):**

The applicable Extra and/or Credit unit prices per linear foot including drilling, reinforcing and concrete shown on the successful contractor's Bid Form.

#### **COLUMN "E" - NET EXTRA COST OR CREDIT DUE PER PIER:**

Net extra cost or credit due per individual pier (exclusive of casing, if required).

#### **COLUMN "F" - GROUND ELEVATION AT PIER:**

The elevation of ground at pier at time pier is drilled.

#### **COLUMN "G" - ESTIMATED CASING LENGTH:**

The estimated total linear feet of casing required for bidding purposes.

#### **COLUMN "H" - ACTUAL CASING LENGTH:**

The actual total linear feet of casing utilized during drilling.



SECTION 32 11 13.13

LIME-TREATED SUBGRADES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Foundation course of lime stabilized natural subgrade material.

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 D698 - Tests for Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 5.5 lb Rammer and 12 inch Drop.
- B. ASTM D1140 - Method of Test for Amount of Material in Soils Finer than the No. 200 Sieve.
- C. ASTM D1556 - Density of Soil in Place by the Sand-Cone Method.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- G. TxDOT Tex-600-J - Lime Testing Procedure.
- H. Geotechnical Engineering Soils Report.

1.4 SUBMITTALS

- A. Submittals shall conform to requirements of Division 1.
- B. Submit certificates stating that hydrated lime, quicklime, or commercial lime slurry complies with these specifications.
- C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.
- D. Submit manufacturer's description and characteristics for rotary speed mixer and compaction equipment for approval.

1.5 TESTS

- A. Testing will be performed under provisions of Section - Testing Laboratory Services.
- B. Tests and analysis of soil materials will be performed in accordance with ASTM D4318.
- C. Sampling and testing of lime slurry shall be in accordance with Tex-600-J.
- D. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.



- E. Soil will be evaluated to establish percent of hydrated lime, quicklime, or lime slurry to be applied to sub grade material.
- F. Moisture-density relationship will be established on material sample from roadway, after stabilization with lime, in accordance with ASTM D698.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.
- B. Store lime in weatherproof enclosures. Protect lime from ground dampness.
- C. Quicklime can be dangerous; exercise extreme caution if used for the Work. Contractor shall become informed about recommended precautions in the handling, storage and use of quicklime.

### PART 2 P R O D U C T S

#### 2.1 WATER

- A. Water shall be clean; clear; and free from oil, acids, alkali, or vegetable matter.

#### 2.2 LIME

- A. Type A - Hydrated lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide and magnesium hydroxide.
- B. Type B - Commercial lime slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.
- C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:
  - 1. Grade DS: Pebble quicklime of a gradation suitable for use in the preparation of a slurry for wet placing.
  - 2. Grade S: Finely-graded quicklime for use in the preparation of slurry for wet placing. Do not use grade S quicklime for dry placing.
- D. Lime shall conform to requirements of Item 260 of the 1993 Texas Department of Transportation Standard Specifications.
- E. Lime slurry may be delivered to the job site as commercial lime, or may be prepared at the job site by using hydrated lime or quicklime. The slurry shall be free of liquids other than water and shall be of a consistency that can be handled and uniformly applied without difficulty.

### PART 3 E X E C U T I O N

#### 3.1 EXAMINATION

- A. Verify compacted sub grade is ready to support imposed loads.
- B. Verify sub grade lines and grades are correct.

### 3.2 PREPARATION

- A. Complete backfill of new utilities below future grade.
- B. Cut material to bottom of sub grade using an approved cutting and pulverizing machine meeting following requirements:
  - 1. Cutters accurately provide a smooth surface over entire width of cut to plane of secondary grade.
  - 2. Visible indication that cut is to proper depth.
- C. Alternatively, scarify or excavate to bottom of stabilized sub grade. Remove material or windrow to expose secondary grade. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting. Obtain uniform stability.

### 3.3 LIME SLURRY APPLICATION

- A. Mix hydrated lime or quicklime with water to form a slurry of the solids content specified. Commercial lime slurry shall have dry solids content as specified. Conform to cautionary requirements of Paragraph 1.06C concerning use of quicklime.
- B. Apply slurry with a distributor truck equipped with an agitator to keep lime and water in a consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on the same working day.
- C. Apply so that dry sub grade will contain a minimum lime content of 7 percent by weight of dry sub grade unless otherwise instructed by Testing Laboratory.

### 3.4 PRELIMINARY MIXING

- A. Do not mix and place material when temperature is below 40 degrees F and falling. Base may be placed when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.
- B. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain a homogeneous friable mixture free of clods and lumps.
- C. Shape mixed sub grade to final lines and grades.
- D. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.05C can be met during preliminary mixing:
  - 1. Seal sub grade as a precaution against heavy rainfall by rolling lightly with light pneumatic rollers.
  - 2. Cure soil-lime material for 1 to 4 days. Keep sub grade moist during cure.

### 3.5 FINAL MIXING

- A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.
- B. Add water to bring moisture content of soil mixture to a minimum of optimum or above.
- C. Mix and pulverize until all material passes a 1-3/4-inch sieve; a minimum of 85 percent, excluding nonslacking fractions, passes a 3/4-inch sieve; and a minimum of 60 percent excluding nonslacking fractions passes a No. 4 sieve.
- D. Shape mixed sub grade to final lines and grades.
- E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

### 3.6 COMPACTION

- A. Aerate or sprinkle to attain optimum moisture content as determined by Testing Laboratory. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.
- B. Start compaction immediately after final mixing, unless approved by Engineer.
- C. Spread and compact in two or more approximately equal layers where total compacted thickness is to be greater than 8 inches.
- D. Compact with approved heavy pneumatic or vibrating rollers, or a combination of tamping rollers and light pneumatic rollers. Begin compaction at the bottom and continue until entire depth is uniformly compacted.
- E. Do not allow stabilized base to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.
- F. Compact to following minimum densities at a moisture content of optimum to 3 percent above optimum as determined by ASTM D698, unless otherwise indicated on the Drawings:
  - 1. Areas to receive pavement without subsequent base course: Minimum density of 98 percent of maximum dry density.
  - 2. Areas to receive subsequent base course: Minimum density of 95 percent of maximum dry density.
- G. Seal with approved light pneumatic tired rollers: Prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

### 3.7 CURING

- A. Moist cure for a minimum of 3 days before placing base or surface course, or opening to traffic. Time may be adjusted as approved by Engineer. Sub grade may be opened to traffic after 2 days if adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.
- B. Keep sub grade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
- C. Place base, surface, or seal course within 14 days after final mixing and compaction unless prior approval is obtained from the Engineer.

### 3.8 TOLERANCES

- A. Completed surface shall be smooth and conform to typical section and established lines and grades.
- B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16 foot length.

### 3.9 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section - Testing Laboratory Services.
- B. A minimum of one phenolphthalein test will be made at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.
- C. Contractor may, at his own expense, request additional cores in the vicinity of cores indicating nonconforming in-place depths. If the average of the tests falls below the required depth, place and compact additional material at no cost to the Owner.
  - 1. Compaction Testing will be performed in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017 at random locations near depth determination tests. Rework and recompact areas that do not conform to compaction requirements at no cost to the Owner.

- D. Fill test sections with new compacted lime stabilized sub grade.

3.10 PROTECTION

- A. Maintain stabilized sub grade to lines and grades and in good condition until placement of base or surface course. Protect the asphalt membrane, if used, from being picked up by traffic.
- B. Repair defects immediately by replacing material to full depth.

END OF SECTION 32 11 13.13

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## SECTION 32 11 16

### DRAINAGE STONE BASE

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. Section Includes: Drainage stone base material under synthetic grass surfacing.

B. Related Sections:

1. Section 11 68 00 - Play Field Equipment and Structures.
2. Section 32 18 13 - Synthetic Grass Surfacing
3. Section 32 18 14 - Paved Elastic Layer

##### 1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 33 23 - Shop Drawings, Product Data and Samples.

B. Submit test reports from commercial laboratory as outlined herein.

C. Submit reproducible drawing as described under "Record Drawings" Paragraph prior to placement of synthetic turf.

#### PART 2 - PRODUCTS

##### 2.1 DRAINAGE STONE BASE

A. Drainage stone base shall consist of a 4" coarse utility drainage stone base topped with a 2" layer of crushed limestone finish course. Stone base material used shall be obtained from crushing limestone. Crushed stone used on this project shall conform to the requirements of ASTM C33 - #57, ASTM C33 - #8, and AASHTO. Stone shall conform to the following sieve analysis.

Sieves	Base Stone	% Passing	Finish Course
3"	---		---
2"	---		---
1 1/2"	100		---
1"	95-100		---
3/4"	---		---
1/2"	25-60		100
3/8"	---		85-100
1/4"	25-65		---
#4	0-10		10-30
#8	0-5		0-10
#16	---		0-5

B. Drainage stone base system shall have a minimum percolation rate of 30" per hour. Contractor shall provide test results that confirm the base system meets this requirement.

C. Material source must be approved by the Architect.

## 2.2 HDPE LINER

- A. Provide "Titan 20", a 20-mil liner of woven strips of HDPE (High-Density Polyethylene) encased in low density polyethylene coating as manufactured by Titan Environmental USA and Intertape Polymer Group (IPG) or equivalent.

1. System has the following performance properties:

TESTED PROPERTY	TEST METHOD	UNIT
Tensile	D7003	133 lb./in.
Tear Resistance	D5844	60 lbs.
Puncture Resistance	D4833	113 lbs.
Weight	---	.05 lb./sq.ft.
Hydrostatic Resistance	D6241	922 lb.
Low Temperature Flex	D2136	Md & TD: Pass @ -40 C
CBR Static Puncture	D6241	922 lbs.
Tongue Tear-Large Scale	D5884	MD & TD: 60 lbs.
MVTR	E96	0.40 g/m <sup>2</sup> 24 hr
Mullen Burst	D751	375 psi
Hydraulic Conductivity	(from MVTR)	1.97 x 10 <sup>-12</sup> cm/s
Carbon Black Content	D4218	3%

## PART 3 - EXECUTION

### 3.1 PREPARATION OF SUBGRADE

- A. The subgrade shall be excavated and shaped in conformity with the typical sections shown on drawings. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material. All holes, ruts and depressions shall be filled with approved material and, if required, the subgrade shall be thoroughly wetted with water and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material. Subgrade shall be proof rolled to detect any soft spots. The surface of the subgrade shall be shaped with laser guided equipment and shall be finished to line and grade as established and in conformity with the typical section shown on drawings, and any deviation in excess of 0.1 foot in cross section and in a length of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling. Sufficient subgrade shall be prepared in advance to insure satisfaction prosecution of the work.

### 3.2 PLACEMENT OF GEOTEXTILE

- A. Prior to placing the drainage stone base, liner shall be spread over the entire subgrade so that none of the stone base comes in contact with the existing soil. Install liner in strict accordance with manufacturer's written instructions and recommendations, including overlapping and 'welding' seams.

### 3.3 PLACING

- A. The base stone and finish course material shall be delivered in approved vehicles of a uniform capacity, and it shall be the charge of the Owner that the required amount of specified material shall be delivered to secure the proper thickness of each course. Material shall be dumped around the perimeter of the field and spread with tracked equipment. Spreading equipment shall always be fully supported by the stone base material. Contractor shall avoid overstressing the soils by utilizing equipment that spreads the base material and only exerts moderate pressure on the subgrade. Rutting at the time of placement is an indication of overstressing the subgrade. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period, the material shall be scarified and spread as directed by the Owner's Representative. The material shall be sprinkled, if directed, and shall then be bladed, dragged and shaped with laser guided equipment to conform to typical sections as shown on drawings. All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well graded material.

### 3.4 COMPACTION

- A. The stone base shall be sprinkled and compacted with four passes of a steel-wheeled, minimum 20-ton vibratory roller. Any areas of material that do not compact properly will be corrected immediately by scarifying the area affected, reshaping and recompacting.

3.5 FINISH GRADING

- A. The drainage stone base shall be fine graded using laser guided equipment. The finish grade shall be within 0.01 foot of proper subgrade elevation.

3.6 RECORD DRAWINGS

- A. Upon completion of the stone base grading and compaction the Contractor shall paint a twenty foot (20') grid over the entire field. Grade shots will be taken by a registered public surveyor at each grid line intersection. The grades will be transferred to a reproducible drawing of the football field. The Synthetic Turf Installation Contractor and the Architect must approve the Record Drawings prior to placement of the synthetic turf. The Synthetic Turf Installation Contractor and the Architect must visually observe the painted grid lines to determine if there are any high spots, low spots, undulations, etc., in the stone base. Any irregularities that will affect the accuracy of the yard lines on the field shall be corrected prior to placement of the synthetic turf.

END OF SECTION



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SECTION 32 11 29.13

LIME-FLY ASH-TREATED BASE COURSES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Foundation course of lime/fly ash stabilized sub grade material.
  - 1. Application of lime slurry and fly ash to sub grade.
  - 2. Mixing, compaction, and curing of lime, slurry, fly ash, water and sub grade into a stabilized foundation.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Measurement for lime stabilized subgrade, when included in the Bid Form, is on a square yard basis. Separate measurement will be made for each different required thickness of base course.
  - 2. Measurement for hydrated lime and quicklime, when included in the Bid Form, is by the ton of 2,000 pounds dry-weight basis.
  - 3. Measurement for commercial lime slurry, when included in the Bid Form, is by the ton of 2,000 pounds of lime calculated on the percentage by weight of dry solids for the grade of slurry.
- B. 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. Moist Cure: Curing soil lime/fly ash material to obtain optimum hydration.
- B. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted sub grade for other than full-lane-width roadway sections.

1.4 REFERENCES

- A. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.

1.5 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit certification that fly ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.
- C. Submit weight tickets, certified by supplier, with each bulk delivery of materials to work site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Conform to requirements of Division 2.
- B. Quicklime can be dangerous; exercise extreme caution if used for Work. Become informed about recommended precautions in handling, storage and use of quicklime.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Water: clean, clear and free from oil, acids, alkali, or vegetable matter.
- B. Conform to requirements of City of Houston Standard Specifications Section 02336 – Lime Stabilized Subgrade for Type A hydrated lime, Type C quicklime, and Type B commercial lime slurry.
- C. Fly ash: Residue or ash remaining after burning finely pulverized coal at high temperatures conforming to requirements of ASTM C 618, Type 'C' or 'F' and following:
  - 1. Minimum CaO content of 20 percent
  - 2. Loss on ignition not to exceed 3 percent
  - 3. Contain no lignite ash
- D. Asphaltic Seal Cure: Conform to requirements of Division 32.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Conform to City of Houston Standard Specifications Section 32 11 13.13 – Lime Stabilized Subgrade with following exceptions:
  - 1. Include fly ash in percentage amounts in lime or lime slurry as established from geotechnical evaluation for application, mixing, and compaction.
  - 2. Apply lime/fly ash as single mix, single pass over lower PI soils.
  - 3. Conduct operations to minimize elapsed time between mixing and compacting lime/fly ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing last stabilizing agent.

### 3.2 QUALITY CONTROL

- A. Testing will be performed under provisions of Division 1.
- B. Soil will be sampled to establish percent of fly ash and hydrated lime, quicklime, or lime slurry to be applied to sub grade material.
- C. Testing will be in accordance with Division 1.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for concrete paving will be on a square yard basis.
- B. 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. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.
- T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
- U. TxDOT Tex-203-F - Sand Equivalent Test.
- V. TxDOT Tex-406-A - Material Finer than 75 Fm (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

#### 1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual flexural strength obtained from design mixes at required test ages.
- C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.
- D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 82. Provide specimens for testing when required by Owner's Representative.
- E. CHPS Submittals:
  - 1. Product Data for Credit ME 4.1: For structural steel products (including reinforcing steel), documentation indicating percentages by weight of post-consumer recycled content. Project requirement is a minimum 67% post-consumer recycled content for all structural steel.

#### 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:

<u>Item</u>	<u>Percent by Weight of Total Sample Maximum</u>
Clay lumps and friable particles	3.0
Material finer than 75-um (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All other concrete	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

\* In case of manufactured sand, when material finer than 75-μm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 1/2 inch to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

<u>Sieve Designation (Square Openings)</u>	<u>Percentage by Weight</u>
Retained on 1 3/4" sieve	0
Retained on 1 1/2" sieve	0 to 5
Retained on 3/4" 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:

<u>Sieve Designation (Square Openings)</u>	<u>Percentage by Weight</u>
Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.

- E. Mineral Filler: Type "C" or Type "F" fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture as approved by the Engineer. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementitious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.
- F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.
- G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Owner's Representative.
- H. Reinforcing Steel:
  - 1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.
  - 2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.
  - 3. Provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.

## 2.2 EQUIPMENT

- A. Conform Equipment to requirements of ASTM C 94.

## 2.3 MIXING

- A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.
- B. Mix design to produce concrete which will have minimum compressive strength of 3,000 psi at 7 days and 3,500 psi at 28 days. Slump of concrete shall be at least 2 inches but no more than 6 inches, when tested in accordance with ASTM C 143.
  - 1. Concrete pavement coordinate with curb and gutter spec section 32 16 13, 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. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.
- D. Hand Finishing:
  - 1. Provide mechanical strike and tamping template 2 feet longer than width of pavement to be finished. Shape template to pavement section.
  - 2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.
- E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10 ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3 foot width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.
- F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.



- G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.
1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.
  2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.
  3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

### 3.4 FORMS

- A. Side Forms: Use forms of approved shape and section. Form depth shall be equal to required edge thickness of pavement. Forms with depths greater or than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1 inch. Length of form sections shall be not less than 10 feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200 foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10 feet in length or curved forms may be used.
- B. Form Setting:
1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 feet of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300 feet ahead of mixer or as approved by Owner's Representative.
  2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

### 3.5 REINFORCING STEEL AND JOINT ASSEMBLIES

- A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.
- B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.
- C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.
- D. Secure in required position to prevent displacement during placing and finishing of concrete.
- E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.

- F. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

### 3.6 FIBROUS REINFORCING

- A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

### 3.7 PLACEMENT

- A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.
- B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.
- C. Concrete slump during placement shall be 2 to 6 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 one specimen at 7 days or at number of hours as directed by the Owner's Representative for high early strength concrete. Test two specimens at 28 days. Test remaining specimens at 56 days, if required. 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, perform yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.
- D. Minimum of one 4 inch core will be taken at random locations per 375 feet per 12 feet lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3000 pounds per square inch.
- E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in-place depths at no cost to Owner. In-place depth at these locations shall be average depth of four cores.
- F. Fill cores and density test sections with new concrete paving or non shrink grout.

### 3.14 NONCONFORMING PAVEMENT

- A. Remove and replace areas of pavement found deficient in thickness, or that fail compressive strength tests, with concrete of thickness shown on Drawings.
- B. When measurement of any core is less than specified thickness, actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to Owner.

3.15 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

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SECTION 32 13 13.10

CONCRETE PAVEMENT CURING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Curing of Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for concrete curing shall be incidental to concrete paving.
- B. 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/m<sup>2</sup> 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

SECTION 32 13 13.25

CONCRETE SIDEWALKS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statutes.

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. CHPS Submittals:
  - 1. Product Data for Credit ME 4.1: For structural steel products (including reinforcing steel), documentation indicating percentages by weight of post-consumer recycled content. Project requirement is a minimum 67% post-consumer recycled content for all structural steel.

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. An additional test specimen performed at 56 days, if required. 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

SECTION 32 13 73

CONCRETE PAVING JOINTING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.
- B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No separate payment for street pavement expansion joints. Include cost for work in unit price bid for related work.
  - 2. No separate payment for saw-cutting existing concrete or asphalt pavement for new joints. Include cost for work in unit price bid for related work.
  - 3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include cost for work in unit price bid for related work.
  - 4. No separate payment will be made for joints for curb, curb and gutter, concrete sidewalks, and concrete driveways. Include cost for work in unit price bid for related work.
- B. 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

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SECTION 32 16 13

CURBS AND GUTTERS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.
- B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb, when included on the bid form, is on a linear foot basis measured along face of curb.
- B. 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 details of proposed form work for approval.
- C. CHPS Submittals:
  - 1. Product Data for Credit ME 4.1: For structural steel products (including reinforcing steel), documentation indicating percentages by weight of post-consumer recycled content. Project requirement is a minimum 67% post-consumer recycled content for all structural steel.

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 for welded wire fabric of Division 32.
- C. Grout: Nonmetallic, nonshrink grout containing no chloride producing agents conforming to following requirements.
  - 1. Compressive strength
    - a. at 7 days: 3500 psi
    - b. at 28 days: 4000 psi
  - 2. Initial set time: 45 minutes
  - 3. Final set time: 1.5 hours
- D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.
- E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Division 32.
- F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Owner's Representative.

PART 3 EXECUTION



### 3.1 PREPARATION

- A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and sub grade and roadbed.

#### PLACEMENT

- B. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.
- C. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.
- D. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.
- E. Joints: Place in accordance with Division 32. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4 inch deep using approved edging tool.
- F. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

### 3.2 MANUAL FINISHING

- A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.
- B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.
- C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.
- D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.
- E. Edge outer edge of gutter with 1/4 inch edger. Finish edges with tool having 1/4 inch radius.
- F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

### 3.3 MECHANICAL FINISHING

- A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Owner's Representative. Use of mechanical methods shall provide specified curb design and finish.

### 3.4 CURING

- A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Division 32.

### 3.5 TOLERANCES

- A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.6 PROTECTION

- A. Maintain curbs and gutters in good condition until completion of Work.
- B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

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SECTION 32 17 23

PAVEMENT MARKINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. This Section specifies the requirements for providing pavement markings of the following types.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for pavement markings will be on a lump sum basis.
- B. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 QUALITY ASSURANCE

- A. All markings shall comply with the requirements of the SDHPT Standard Specifications for Construction of Highways, Streets and Bridges, the SDHPT Manual on Uniform Traffic Control Devices for Streets and Highways and the applicable regulations and standards of Harris County, Texas and the City.
- B. Reference Standards Applicable to this Section:
  - 1. FS: Federal Specifications and Standards:
    - a. TT-P-1952E: Paint, Traffic and Airfield Marking, Waterbourne
  - 2. SDHPT: Texas State Department of Highways and Public Transportation:
    - a. Standard Specifications for Construction of Highways, Streets and Bridges.
    - b. Texas Manual on Uniform Traffic Control Devices for Streets and Highways (TMUTCD).
    - c. The above referenced SDHPT standards may be obtained from:
  - 3. State Department of Highways & Public Transportation Highway Building
  - 4. 11th and Brazos Streets
  - 5. Austin, Texas 78701
  - 6. Tel: (512) 475-2081

1.4 SUBMITTALS

- A. Certificates:
  - 1. Certificates shall be submitted for each product indicating that the product complies with the requirements of this specification.
- B. Manufacturer's Data:
  - 1. Manufacturer's installation instructions, specifications and recommendations shall be submitted for each pavement marking product.

1.5 JOB CONDITIONS

- A. Markings shall be installed only on clean and dry surfaces. Paint markings shall be applied only when surfaces have the following minimum temperatures:

1. A minimum of 50 degrees F for asphalt and a minimum of 60 degrees F for concrete.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### A. Paint:

1. Marking paint shall be traffic yellow, or as designated on the drawings, and shall comply with the requirements of FS TT-P-1952E.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Markings shall be installed and surfaces prepared in accordance with the requirements of the applicable item in the SDHPT Standard Specifications and the TMUTCD.
- B. Markings shall be protected from vehicular traffic until not subject to damage by such traffic. Contractor shall be responsible for repair and replacement of markings until written acceptance by the Owner.

END OF SECTION

SECTION 32 18 13

SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, tools and equipment necessary to install, in place, all synthetic turf material as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's written installation instruction, and in accordance with all approved shop drawings.
- B. Prior to order of materials, the Turf Contractor shall submit the following:
  - 1. Product Data including Independent Test Lab Results
  - 2. Installation details
  - 3. Sample Warranty
  - 4. Field layout and striping plans
  - 5. Details on construction, especially any details that may deviate from plans and specifications.
- C. Prior to the beginning of installation, the manufacturer/installer of the synthetic turf shall inspect the subbase and supply a Certificate of Subbase Acceptance for the purpose of obtaining manufacturer's warranty for the finished synthetic playing surface.
- D. Prior to Final Acceptance, the Contractor shall submit to the Owner three (3) copies of Maintenance Manuals, which will include necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and striping.
- E. Related Sections:
  - 1. Section 11 68 00 - Play Field Equipment and Structures
  - 2. Section 32 11 16 - Graded Stone Base.
  - 3. **Section 32 18 14 - Paved Elastic Layer**

1.2 SHOP DRAWINGS

- A. Shop drawings shall be prepared at the scale of the construction documents and contain all pertinent information regarding installation. These drawings shall be submitted to the Architect/Owner for approval prior to the manufacturing and shipment of materials.
- B. Submit drawings for:
  - 1. Installation details; edge detail, goal post detail, other inserts and covers, etc.
  - 2. Striping plan; layouts showing any field lines, markings and boundaries, and field logos per project drawings.

1.3 QUALITY ASSURANCE

- A. Manufacturer/Installer's Experience: The synthetic turf installer/manufacture shall have the experience of at least ten (10) acceptable installations of full-size football or soccer fields (minimum of 70,000 SF) in the United States within the past five (5) years of tufted, mono-fiber grass-like fabric that are infilled with a layered system of pea gravel and rubber. Provide this listing with the bid. The Turf Contractor shall employ only qualified, experienced supervisors and technicians skilled in the installation of the specified system.
- B. Turf Contractor shall meet the following criteria:
  - 1. Have proper license, in good standing, and have never had a license revoked.
  - 2. Have not had a Surety or Bonding Company finish work on any contract within the last five (5) years.
  - 3. Have not been disqualified or barred from performing work for any public Owner or other contracting entity.

#### 1.4 EXISTING CONDITIONS

- A. If the surface on which the new synthetic turf system is to be placed is an existing concrete base, the Turf Contractor will be responsible for any damage to the concrete during removal/installation of the synthetic turf system. The football goal posts, if any, are to be removed and reinstalled by the Owner or Prime Contractor to facilitate the installation of the new synthetic turf system.
- B. If the surface on which the new synthetic turf system is to be placed is a new asphaltic concrete base or a new base of porous aggregate, the Synthetic Turf Contractor will be responsible for any damage to the subbase during removal/installation of the synthetic turf system after the deficiencies (if any) have been corrected as noted on the Certificate of Subbase Acceptability. New football goal posts and/or infield dirt mix backfill within the contiguous turf limits or immediately adjacent thereto are not to be installed by the Owner/Prime Contractor until after the new synthetic turf system has been completed.

#### 1.5 SCHEDULE

- A. Turf Contractor shall complete all work on the synthetic turf system in accordance with the published project schedule.
- B. The Turf Contractor will require unencumbered use of an area within 30 feet of the synthetic turf area(s) being installed in order to complete his work. Turf Contractor shall also be afforded unencumbered access through the construction site to reach the turf field area being installed.

#### 1.6 SURFACE AREA

- A. The Turf Contractor is to verify all measurements.

#### 1.7 UTILITIES

- A. Owner/Prime Contractor will supply necessary water, adequate lighting and electricity for installation.

#### 1.8 WARRANTY

- A. Warranty: The Contractor shall submit its Manufacturer's Warranty with (3rd party) verification manufacturing was to standards. The warranty guarantees the usability and playability of the synthetic turf system for its intended uses for an eight (8) year period commencing with the date of Substantial Completion.
  - 1. The warranty submitted must have the following characteristics:
    - a. Must provide coverage for eight (8) years from the date of Substantial Completion.
    - b. Must warrant materials and workmanship.
    - c. Must verify through a (3rd party) that the materials installed meet or exceed the product specifications.
    - d. Must have a provision to either make a cash refund or repair or replace such portions of the installed materials that are no longer serviceable to maintain a serviceable and playable surface.
    - e. Must be a manufacturer's warranty from a single source covering workmanship and all self-manufactured or procured materials.
- B. Guarantee that the G-Max rating will not exceed 135 throughout the 8-year warranty period. Manufacturer will be responsible for testing and documenting the result every year of the warranty period.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Provide "Matrix 46 oz." as manufactured by Hellas Construction. Material shall be a tufted, mono-fiber grass-like fabric coated with a secondary backing of high grade polyurethane. The fibers shall be tufted to a finished pile height of approximately 54mm. The turf fabric shall be filled with a layered system of silica pea gravel and rubber.
- B. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified, should be able to withstand full climatic exposure in all climates, be resistant to insect infestation, rot, fungus and mildew; to ultra-violet light and heat degradation, and shall have the basic characteristic of flow through-drainage allowing free movement of surface run-off through the turf fabric where such water may flow to the existing subbase and into the field drainage system.

- C. The finished playing surface shall appear as mowed grass with no irregularities and shall afford excellent traction for conventional athletic shoes of all types. The finished surface shall resist abrasion and cutting from normal use.
- D. Pile yarn (Polyethylene) shall be a proven athletic caliber yarn designed specifically for outdoor use and stabilized to resist the effect of ultraviolet degradation, heat, foot traffic, water and airborne pollutants. The pile fiber shall possess the following physical characteristics:
- E. Infill material shall be a layered system of pea gravel and rubber in accordance with the manufacturer's recommendations and the Owner's preference.
- F. Perimeter and interior edge details, underground storm sewer piping and connections, and goal post foundations required for the system shall be as detailed and recommended by the manufacturer, and as approved by the Owner.

G. Product Characteristics:

<u>Standard</u>	<u>Property</u>	<u>Specification</u>
1. ASTM D418/D5848	Pile Weight	46 oz. /Sq. Yd.
2. ASTM D5848	Primary and Secondary Backing Weight	9.2 oz. /Sq. Yd.
3. ASTM D5848	Secondary Coating Weight	26 oz. /Sq. Yd.
4. ASTM D5848	Total Weight	81.2 oz. /Sq. Yd.
5. ASTM D1907	Yarn Denier	4 single monofilament yarn ends in 1,900 denier lime green 4 single monofilament yarn ends in 1,200 denier dark green
	Total Yarn Denier	12,400
6. ASTM D418/D5848	Pile Height	Finished 2 1/4"
7. ASTM D5793	Tufting Gauge	1/2"
8. ASTM D5848	Primary Backing	Tri-layer woven Polypropylene
9. ASTM D5848	Secondary Coating	Polyurethane
10. ASTM D1335	Tuft Bind without Infill	8 lbs. +/-
11. ASTM D1682/D5034	Grab Tear (width)	250.1 - 273.1 lbs. Force
12. ASTM D1682/D5034	Grab Tear (length)	197.6 - 236.1 lbs. Force
13. ASTM D4991	Carpet Permeability	10 - 15 inches/hour
14. ASTM D2859	Flammability (Pill Burn)	Pass
15. ASTM F355	G-max (Impact Attenuation)	<130 at installation <190 over warranty life
16. ASTM E-11	Realfill™ Infill	6 -7 lbs +/- per square foot
17	Fabric Width	15'
18	Perforation	3/16" Holes 4" X 4"
19 Yarn		160 microns x 1.6 mm (lime green) 125 microns x 1.2 mm (grass green)

All Characteristics listed above nominal +/- 5%

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The installation shall be performed in full compliance with approved shop drawings.
- B. Only factory-trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the synthetic turf manufacturer's installation supervisors shall undertake the placement of the system.
- C. The surface to receive the synthetic turf shall be inspected and certified by the turf manufacturer as ready for the installation of the synthetic turf system and must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.



### 3.2 INSTALLATION

- A. The subbase and curbs shall be inspected by means of a laser level and plotted on a 10-foot grid. Based upon the Contractor's inspection of the topological survey, the Sitework Contractor shall fine grade the subbase suitably, including properly rolling and compacting the base to achieve a surface planarity within  $\frac{1}{4}$ " in 10 feet (+0, -1/4"0). OWNER, ENGINEER OR PRIME CONTRACTOR SHALL NOT APPROVE THE SUBBASE FOR TOLERANCE TO GRADE WITHOUT OBTAINING THE TOPOLOGICAL SURVEY.
- B. The Turf Project Superintendent shall thoroughly inspect all materials delivered to the site both for quality and quantity to assure that the entire installation shall have sufficient materials to maintain the schedule and proper mixing ratios.
- C. Synthetic turf shall be loose laid across the field and attached to the perimeter edge detail. Turf shall be of sufficient length to permit full cross-field installation. No head or cross seams will be allowed, except as required for inlaid fabric striping or to accommodate programmed cut-outs.
- D. All seams shall be flat, tight, and permanent with no separation or fraying. All seams and markings shall be adhered to a special tape with a two-part, high strength polyurethane adhesive applied per the Turf Supplier's standard procedures for outdoor applications.
- E. Infill materials shall be properly applied in numerous thin lifts using special broadcasting equipment to produce a layered system of pea gravel and SBR rubber particles. The turf shall be raked and brushed properly as the mixture is applied. The infill material shall be installed to a depth of about 1.75 inches. The layered system of pea gravel and rubber infill materials can only be applied when the turf fabric is dry.
- F. Should the ambient outdoor temperature fall below 45 degrees F, the Contractor and Owner will discuss available options and/or stoppage of work.

### 3.3 FIELD MARKINGS AND DECORATIONS

- A. The field will have the lines tufted or inlaid according to NCAA or National Federation standards, as applicable.
- B. Line width tolerance is (+)  $\frac{1}{4}$  inch. Alignment tolerance on any one line (sideline, goal line, end line, yard line) is (+)  $\frac{1}{2}$  inch. Any incorrectly installed line shall be immediately removed. If such as line permanently discolors the synthetic turf, that section shall be removed and replaced at the Contractor's expense. All line marking and numbers, etc., shall be per the current University Interscholastic League (U.I.L), NCAA, NFHS, and Owner's recommendations and approval.

### 3.4 CLEANING

- A. Protect installed turf from subsequent construction operations.
- B. Do not permit traffic over unprotected turf surface.
- C. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.
- D. All usable remnants of new material shall become the property of the Owner.
- E. The Contractor shall keep the area clean throughout the project and clear of debris.
- F. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

### 3.5 OTHER MATERIALS AND EQUIPMENT

- A. Maintenance Equipment: Provide one (1) Clean Sweep Jr., towed, non-powered Turf Sweeper with hitch, excluding prime mover vehicle. The sweeper attachment shall be of sufficient size to cover a 36" wide swath in a single pass. The sweeper attachment shall be fitted with synthetic bristle brushes as recommended by the synthetic turf manufacturer and shall be used primarily to collect surface debris.

END OF SECTION

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SECTION 32 18 14

PAVED ELASTIC LAYER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Paved Elastic Layer.
- B. Related Sections
  - 1. Section 32 18 13 - Synthetic Grass Surfacing

1.2 PROPOSAL

- A. The following information shall be submitted to the Owner as part of the proposal.
  - 1. E-Layer - One (1) sample - approximately 12" x 12".

PART 2 - PRODUCTS

2.1 PAVED ELASTIC LAYER

- A. 19mm thick insitu pad of 1-5mm SBR rubber granules and mineral aggregates bound with moisture cured polyurethane binder. Rubber granules shall be placed at 18 lbs./sq.yd., pea gravel at 18 lbs./sq.yd., and binder at 2.9 lbs./sq.yd.

PART 3 - EXECUTION

3.1 PAVED ELASTIC LAYER

- A. Elastic layer shall be pre-mixed and placed with a paving machine in one lift. Lift shall be placed starting at the crown of the field and laid running the length of the field from sideline to sideline.
- B. All joints between passes shall be troweled and compacted by the paving machine operator as the material is placed.
- C. All seams shall be hand rolled.
- D. Locations where elastic layer abuts concrete perimeter curb shall be primed with a polyurethane primer.
- E. Thickness - 19mm.
- F. Elastic layer must cure for 48 hours prior to installation of the synthetic turf system.

END OF SECTION

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SECTION 32 18 23.39

SYNTHETIC RUNNING TRACK SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. All labor and materials necessary to install track surfacing material over the proposed base.
  - 2. Submit "Track Surfacing Contractor's Statement of Qualifications" form attached to the end of this Section.
- B. Related Sections:
  - 1. Section 32 12 16 - Asphaltic Paving
  - 2. Division 33 - Utilities; continuous trench drain

1.2 SUBMITTALS

- A. The following information shall be submitted to the Owner for approval.
  - 1. Standard printed specification of the synthetic track surfacing system for which this bid is submitted.
  - 2. Installation process and requirements:
    - a. Any condition of the concrete and asphalt base that may limit track surface installation or affect the quality of installation.
    - b. Weather or climatic conditions that may limit track surfacing installation.
  - 3. Recommended paint for permanent coloration.
  - 4. A letter, signed by an authorized representative of the track surfacing material manufacturer that the proposed track surfacing material falls within the allowable limits of hazardous materials identified by the EPA.
  - 5. A table that identifies the quantity of each of the following track surfacing materials to be used:
    - a. Rubber granules.
    - b. Binder.
    - c. Primer.
  - 6. Submit written proof that the Track Surfacing Installer has a minimum of five (5) years of experience in successfully installing track surfacing of this type.
- B. The Contractor shall be prepared, at the Owner's request, to provide any and all tests, laboratory analysis, maintenance information, etc., that may be desired.
- C. Codes and Standards:
  - 1. Upon completion of all paint striping, the Contractor shall submit to the Owner a certification of accuracy prepared by a Registered Public Surveyor, that the track striping and layout meets all National Federation of State High School Association and U.I.L. rules and regulations.
  - 2. Codes and standards follow the current guidelines set forth by the International Amateur Athletic Federation (IAAF) and the National Collegiate Athletic Association (NCAA), along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).
- D. Inspection: The Contractor shall, in the presence of the Owner, inspect the track and field events surfacing at the end of the first year of the guarantee period and each year thereafter until the end of the five (5) year guarantee period. Any defects in workmanship or materials (at no fault of the Owner) shall be repaired at the expense of the Contractor to the Owner's satisfaction and at no cost to the Owner.
- E. Material Storage:
  - 1. Track surfacing materials shall be delivered in sealed containers identified with manufacturer's original labeling.
  - 2. Materials shall be stored in a dry location, protected against damage and freezing temperature.
  - 3. All track surfacing material shall be onsite and available for an inventory by the Owner prior to surfacing.
  - 4. All empty track surfacing material drums and bags must remain onsite until all track surfacing material has been installed and their removal is approved by the Owner. The Owner will use the empty drums and containers for a final inventory of installed materials.

### 1.3 QUALITY ASSURANCE

#### A. Installer:

1. The contractor shall have 5 years' experience of successfully installing base mat running tracks and shall have installed a minimum of 10 complete polyurethane running track surfacing systems.
2. The contractor shall be able to furnish evidence that they have been in business for a period of not less than 3 years, under the present name, and if required, furnish financial statements for each of the past 3 years.
3. Contractor is to provide a list of completed facilities, minimum 10, which are certified to meet IAAF/NCAA rules & regulations.
4. The track surfacing installation crew members must be full time employees of track surfacing company. No subcontracting of track surfacing will be allowed.
5. Running track surfacing shall be installed only by trained craftsmen, who are full-time employees. No outside installer or distributor shall be allowed to install Hellas sport surfaces unless licensed.

### 1.4 WARRANTY

- #### A. Guarantee:
- The Contractor shall provide a written five (5) year guarantee. Guarantee shall cover workmanship, labor and materials and shall guarantee the work to be sound for a period of five (5) years from the date of final acceptance. All surfacing shall be guaranteed to the extent that the surfacing: (1) has been manufactured and applied in accordance with these and the manufacturer's specifications; (2) will hold fast and/or adhere to concrete and asphalt base; (3) will perform as specified in these specifications and the specifications of the product manufacturer in the current product information literature and specification sheets; and (4) will not bubble, blister, fade, crack or wear excessively during the guarantee period.

## PART 2 - PRODUCTS

### 2.1 PRODUCT

- #### A. Basis of Design:
- Provide EpiQ V300 as manufactured by Hellas Sport Surfaces a Division of Hellas Const., Inc. (phone: 512.250.2910, website: [www.hellasconstruction.com](http://www.hellasconstruction.com)). Track consists of a base mat made of recycled rubber granules (SBR) bound with a polyurethane binder and a impermeable layer of a bi-component urethane coating, and a pigmented spray-applied top finish of polyurethane spray-coating and EPDM rubber granules.
1. Provide one of the following Products/Manufacturers:  
BSS 200; Beynon (Tarkett Sports Company)  
epiQ Tracks V300; Hellas Construction (Div. of Hellas Construction)  
PTS 3000; Paragon Track Surfaces (Conica)

### 2.2 MATERIALS

- #### A. Primer:
- Polyurethane-based primers especially formulated to be compatible with the base and track surfacing materials.
- #### B. Black SBR Granules:
- The rubber granules for the base mat shall be recycled SBR rubber, processed and chopped to 1-3 mm size, containing less than 4% dust.
- #### C. Polyurethane Binder:
- Binder for the black rubber mat shall be an MDI-based and or MDI/TDI mixture, mono-component, black-pigmented, polyurethane binding agent. The binding agent shall not have a free TDI monomer level above 0.2%, must be black in color and must be solvent free. The binding agent must be specially formulated for compatibility with SBR crumb rubber.
- #### D. Impermeable Layer:
- The resin for this application shall be a pigmented, thixotropic, two-component, polyol and isocyanate, moisture cured, urethane compound and shall be squeegee applied.
- #### E. EPDM Granules:
- The rubber granules for the structural spray wearing coats shall be EPDM peroxide cured, man-made rubber containing a minimum 20% EPDM, with a specific gravity of 1.5+/-0.1, cryogenically processed and chopped 0.5-1.5mm. The EPDM rubber will be the same color as chosen by the architect for the track surface.
- #### F. Structural Spray Coating:
- The spray coating shall be 1-C single component moisture cured, pigmented polyurethane, specifically formulated for compatibility with EPDM granules. The coating shall be the color as selected by the architect.

- G. Line Marking Paint: The line marking paint shall be polyurethane-based paint, specifically manufactured to be compatible with polyurethane synthetic surfaces.

H. Physical Properties

Thickness:	1/2" (13mm)
Shore A Hardness (ASTM D-2240):	55 +/- 5
Elongation at break (ASTM D-412):	+/- 40%
Tensile Strength (ASTM D-412):	0.80 N/mm2@ 70F
Compression Set Recovery (ASTM D-395):	90% - 95% @ 70F over 24-hour period
Abrasion Resistance (ASTM D-501):	0.25 grams loss after 1000 cycles
Chalking (ASTM D-822):	No change after 1000 hours in weather meter.
Coefficient of Friction: (ASTM D-1984)	Dry 0.70 to 0.75 Wet 0.60 to 0.65
Resilience (ASTM-D2632):	38% - 42%
Tear Resistance (ASTM D-624):	60 to 75 psi

PART 3 - EXECUTION

3.1 EXECUTION

- A. Sub-base: The Synthetic Track Surfacing System shall be laid on a sub-base designed and approved by a licensed engineer. The General Contractor shall provide compaction test results of 95% or greater for the installed sub-base and the finished asphalt surface.
- B. For NCAA certification the following criteria must be followed. The track surface i.e., asphalt substrate, shall not vary from planned cross slope by more than +/- .1 % with a maximum lateral slope outside to inside of 1% and a maximum slope of .1% in any running direction. The finished asphalt shall not vary under a 10' straight edge more than 1/8".
- C. It shall be the responsibility of the general contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria.
- D. Upon completion of surface test and correction of any defects, track surface contractor shall submit to Architect/Owner a signed certificate stating the existing surface is acceptable and satisfactory for the installation of his track surface system.
- E. Curing: Before application of the synthetic surface can begin, the asphalt shall be cured for at least 14 - 21 days; and a concrete base a minimum of 28 days.
- F. Cleaning: The area to be surfaced shall be clean and free of any loose or foreign particles (dirt, oil, etc.) prior to commencement of the work. The surface is usually cleaned by use of a power blower and/or high-pressure washer.
- G. Priming: The primer shall be spray-applied in accordance with the manufacturer's specifications. Only those areas that can be installed the same day should be primed.
- H. Base Mat: Mix the black SBR granules and the Binder at a ratio of approximately 5:1 by weight. The exact ratio depends on the dust content of the granules, which should be reduced to a minimum. Mixing time is 2 to 4 minutes, depending on the size of the mixing-batches and the type of mixer used. The blended materials are then spread onto the asphalt or concrete base using a mechanical tandem leveler. The tandem leveler shall have a heated oscillating screed bar to obtain both smoothness and compaction. The heated screed bar normally works at a temperature of 158 to 176 degrees F. The laying procedure shall be bay-to-bay and limiting the length of the passes so as not to have any cold (cured) joints between the bays. At the beginning of each new day's work, the traverse joint from the previous day's work shall be tack coated to ensure a good bond. Small irregularities remaining in the surface after the tandem leveler has passed may be removed using a light polyethylene or Teflon roller.
- I. Impermeable Layer: The "A" and "B" components are mixed at the prescribed ratio homogeneously with a suitable mixing device. This may be a strong drilling machine with a mixing paddle, a static mixing machine or an automatic mixer. The mixing process may last approximately 2 to 4 minutes per batch, depending on the employed mixing unit. This coating is squeegee-applied to the base mat, making it impermeable.



- J. Structural Spray Wear Coats: After the black rubber and sealer coat have cured, the top layer installation consists of the use of Spray Coating and EPDM granules. The base mat must be dry, clean, and free of dust, oils and greases. The Spray Coating material is mixed with the EPDM granules in a suitable device. Application of the mixture is to be effected by use of a structure-spray-machine. To avoid cloud formations and to achieve total coverage of the base mat, apply two applications of the mixture in alternate directions with approximately 1.5 lbs. per square yard per coat. Resistance to abrasion, track spike damage and atmospheric corrosion; and to achieve the longest possible durability, requires installation of the materials in these quantities.
- K. Line Markings: All line and event markings shall be applied by experienced personnel utilizing polyurethane based paint compatible with the synthetic track surfacing. All marking dimensions will be in accordance with the specifications issued by the appropriate sanctioning or governing body such as IAAF, NCAA, NFSHSA, etc.

END OF SECTION

TRACK SURFACING CONTRACTOR'S STATEMENT OF QUALIFICATIONS

Firm Name	Date Organized	Address	
City	State	Zip Code	Telephone

Percentage (%) of work performed by own staff: \_\_\_\_\_

Geographical limits of operation: \_\_\_\_\_

Titles, names and addresses of all principals in firm:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

PERFORMANCE RECORD: (Please complete form.)

FINANCIAL STATUS:

Bonding Capacity	Name and Full Address of Bonding Company
Attach a summary of firm's latest financial statement.	

Date of Statement: \_\_\_\_\_

Complete Name and Address of Firm Preparing Statement
-------------------------------------------------------

REFERENCES: (Bank and Trade. Give complete names and addresses.)

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

I hereby certify as \_\_\_\_\_ Of \_\_\_\_\_  
Title Firm Name  
that all information provided above attached herewith is true and correct.

Name	Signature
	Date

TRACK SURFACING SUBCONTRACTOR'S STATEMENT OF QUALIFICATIONS

PROJECT	CLIENT NAME & PHONE NO.	LOCATION	CONTRACT AMOUNT	COMPLETION DATE
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CURRENT:

COMPLETED:

Have you ever done business under a different name?    ☐ Yes    ☐ No.    If so, give name, location and dates of each operation:

Has firm, under its current or former name(s), ever failed to complete a project, defaulted on a contract, or been engaged in litigation over a project?    ☐ Yes    ☐ No.  
If so, state particulars of each occurrence on separate sheet(s).

SECTION 32 18 23.59

SYNTHETIC TENNIS COURT SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Colored playing surface and striping applied to concrete surfaces.

B. Related Sections

1. Section 03 38 00 - Post-Tensioned Concrete.
2. Section 11 68 00 - Play Field Equipment and Structures
3. Section 32 31 14 - Chain Link Fences - Tennis Courts.

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 printed application specifications for colored playing surface material.

C. Samples: Provide Color and Finish Material samples.

D. Applicator's Certification: Submit evidence of manufacturer's authorization as an approved applicator.

1.3 QUALITY ASSURANCE

A. Applicator: Authorized applicator of surfacing manufacturer.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: Do not apply materials in rainy or foggy conditions, or when temperature is below 50° F, nor when temperature is above 90° F, or when such conditions are anticipated in subsequent 8 hours.

B. Protection: Protect adjacent walks, fences and other surfaces from receiving colored playing surfacing material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Materials specified are products of Neyra Industries, Inc. and are listed as a standard of quality.

2.2 SURFACING AND STRIPING MATERIALS

A. Muriatic Acid: Commercial grade 38% concentrated hydrochloric acid.

B. Primer: DynaFlex Concrete Primer by Neyra Industries, Inc.

C. Masking Tape: 2" wide.

D. Colored Material: DynaFlex-Vinyl by Neyra Industries, Inc.

E. Sand: Clean, hard and sharp, free from clay, salt and organic matter and graded within following limits: This mineral aggregate shall have an American Foundry Society - Grain Fineness Rating of 50 to 75 with no more than 2% retained on 30 mesh or coarser, no more than 12% passing 140 mesh and no more than 3% passing 200 mesh.

F. Water: Clean, drinkable.

- G. Striping Paint: Dynastripe-Vinyl, White, by Neyra Industries, Inc.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect surface for conditions and defects that will adversely affect quality of work, and which cannot be put into acceptable conditions through normal preparatory work.
- B. Do not start work until unsatisfactory conditions are corrected.
- C. Do not start work until excess concrete or other imperfections or contaminants have been removed from surface.

### 3.2 APPLICATION

- A. Application will start only after:
  - 1. Architect has accepted entire surface of entire courts as to texture, ponding of water and drainage.
  - 2. Concrete (with no curing compound) has cured a minimum of 60 days.
  - 3. Fence posts, fence, net posts and center tie-down anchors have been installed and have protection from acid and surfacing material.
  - 4. Minimum 8' opening temporarily made in either end of court, and permanently replaced upon completion of striping and acceptance.
- B. Etch entire surface with a 1:4 solution of muriatic acid, and flush to neutrality with vehicle equipped with water hose with minimum 180 pounds pressure.
- C. After flushing operation has dried a minimum of 48 hours under good drying conditions, apply one spray coat of primer over entire area at a rate of 0.04 to 0.05 gallon per sq. yd. (180 to 225 sq.ft. per gallon).
- D. After primer has cured a minimum of 10 hours, install 2" masking tape around inside perimeter of courts, placing tape next to fence posts.
- E. Apply first coat of colored material with special sand to entire area at right angle to net line with special 30" rubber squeegee. Coverage 0.10 to 0.15 gallon per sq.yd. (60 to 90 sq.ft. per gallon) sand - 5 to 6 pounds per gallon of colored material.
- F. After first coat has dried, scrape off any ridges, drips or foreign matter with snub-nose trowel or scraper, then apply second coat of colored material with 1 to 2 pounds per gallon colored material, to entire area, but crossways (90°) to first coat, in same manner. Coverage: 0.06 to 0.08 gallons per sq.yd. (75 to 112 sq.ft. per gallon).
- G. Dilution: Maximum 10% of volume of colored material may be used to maintain workability with sand.
- H. Remove 2" masking tape from around court. Do not damage coating in removal.
- I. After second coat has dried under good drying conditions a minimum of 24 hours, lay out each court per drawings, using minimum 2" wide masking tape, and spray apply lines using striping paint. Do not apply striping paint in high winds.
- J. After striping has cured, remove tape using care not to destroy surfacing material.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Galvanized steel chain link fences.
  - 2. Manual swinging personnel gates.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-in-place Concrete
  - 2. Section 32 31 13.26 - Chain Link Fences - Tennis Courts
  - 3. Section 32 31 19 - Decorative Metal Fences and Gates

1.2 SUBMITTALS

- A. General: Submit shop drawings, product data, and manufacturer's installation instructions in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Include plan layout, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide chain link fences and gates as manufactured by one of the following:
  - Allied Tube & Conduit (Div. of Atkore International, Inc.)
  - Anchor Fence, Inc.
  - General Wire & Supply Co.
  - Master Halco, Inc.
  - Merchants Metals, Inc. (Div. of Oldcastle Building Products, Inc.)
  - Southwestern Wire, Inc.

2.2 MATERIALS

- A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12 feet high. All fencing shall have a knuckled selvage top and bottom. Wire size includes zinc coating. Provide 2-inch mesh, 9-gage (0.148-inch diameter) wire, typical.
- B. Galvanized Steel Finish: ASTM A 392, Class 1, with not less than 1.2 oz. zinc per sq. ft. of uncoated wire surface.
- C. Framing: Strength requirements for posts and rails shall comply with ASTM F 1043.
- D. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

NPS in inches	Outside Diameter (OD) in inches	Type I Steel	Type II Steel
1-1/4	1.660	2.27	1.84
1-1/2	1.900	2.72	2.28
2	2.375	3.65	3.12
2-1/2	2.875	5.79	4.64
3-1/2	4.000	9.11	6.56

- E. Steel Framework, General: Posts, rails, braces, and gate frames.
  - 1. Type I Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.

CHAIN LINK FENCES AND GATES

2. Type II Pipe: Manufactured from steel conforming to ASTM A 569 or A 446, grade D, cold formed, electric welded with minimum yield strength of 50,000 psi and triple coated with minimum 0.9 oz. zinc per sq. ft. after welding, a chromate conversion coating and a clear polymer overcoat. Corrosion protection on inside surfaces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5 percent Red Rust.
- F. End, corner, and pull posts: 2.875-inch OD Type I or II steel pipe.
- G. Line or intermediate posts: 2.375-inch OD Type I or II steel pipe.
- H. Top Rail: Manufacturer's longest lengths, with expansion-type couplings, approximately 6 inches long, for each joint. Provide means for attaching top rail securely to each gate corner, pull, and end post.
1. Galvanized Steel: 1-1/4-inch NPS (1.66-inch OD) Type I or II steel pipe.
- I. Tension Wire: ASTM A 824, 0.177-inch-diameter metallic-coated steel marcelled tension wire with finish to match fabric.
- J. Tie Wires: 12-gauge (0.106-inch diameter) galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating of surface area in accordance with ASTM A 641, Class 3.
- K. Post and Line Caps: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.
- L. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2 inches less than full height of fabric, minimum cross-section of 3/16 inch by 3/4 inch and minimum 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.
- M. Tension and Brace Bands: Minimum 3/4-inch-wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.
1. Tension and Brace Bands: Minimum 12 gage (0.105 inch) thick.
- N. **Gates:**
1. 1.990 in. o.d. galvanized pipe frames, welded construction.
  2. 1.660 in. o.d. pipe internal bracing.
  3. Standard-type hinges, heavy malleable iron, constructed to allow gate to swing 90 deg. or 180 deg.
  4. Provide fork latch with padlocking device.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed.
- B. Setting Posts: Set posts in concrete footing as detailed. Space maximum 10 feet o.c. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
- C. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.
- D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- E. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 11-gage hog rings of same material and finish as fabric wire, spaced maximum 24 inches o.c.
- F. Tension or Stretcher Bars: Thread through or clamp to fabric 4 inches o.c., and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.

- G. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
  - 1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.
- H. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

### 3.2 GROUNDING

- A. Ground all fences and electrical equipment attached to the fences as required by applicable code.

### 3.3 FIELD QUALITY CONTROL

- A. Tolerances: Posts shall be straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched.
- B. Provide fencing and gates that are true to line with maximum 1/2 inch deviation from the established centerline between line posts.
- C. Repair defects as directed.

### 3.4 ADJUSTING AND CLEANING:

- A. Test each gate operator installed to verify proper operation. Make necessary adjustments to provide proper operation.
- B. Verify that all specified accessory items have been furnished and installed.

END OF SECTION



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SECTION 32 31 13.26

CHAIN LINK FENCES - TENNIS COURTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Chain link tennis court fencing.
- B. Related Sections:
  - 1. Section 11 68 00 - Play Field Equipment and Structures; tennis court equipment.
  - 2. Section 32 18 23.59 - Synthetic Tennis Court Surfacing.
  - 3. Section 32 31 13 - Chain Link Fences and Gates.

1.2 SUBMITTALS

- A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include drawings showing sizes, layout, details of fabrication and installation.

1.3 QUALITY ASSURANCE

- A. Erector Qualifications: Minimum of five years experience installing similar fencing.
- B. Tolerances: Conform to Fed. Spec. RR-F-191H tolerances for framework and fabric.

1.4 COORDINATION

- A. Coordinate installation of fence posts with tennis court construction and with application of tennis court surfacing. Prior to application of tennis court surfacing, install fence posts with fabric in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fabric: ASTM A 392, Class 1, zinc-coated steel, one-piece fabric, full-height, No. 11 ga. wire, 1-3/4 in. mesh, knuckled selvage top and bottom.
- B. Rails: ASTM A 120.
  - 1. Top Rail: 1-1/4 inch schedule 40 galvanized steel pipe, 1.660 in. o.d. 2.27 lbs. per ft., with outside sleeve-type couplings at least 7 inches long.
  - 2. Bottom and Intermediate Rails: 1-1/4 inch schedule 40 galvanized steel pipe, 1.660 in. o.d. 2.27 lbs. per ft., with rail end clamps at each post.
- C. Braces: Same as top rail with a 3/8 in. galvanized rod trussed from line post back to terminal post, complete with truss tightener. Provide at corner and gate posts.
- D. Terminal, Line, Corner, and Pull Posts: ASTM A 120, 3-1/2 inch schedule 40 galvanized pipe, 4 in. o.d., 9.1 lbs. per ft., end, corner, line, and pull posts. Equip posts with 3/16 in. x 3/4 in. tension bar, No. 11 ga. by 3/4 in. wide tension bands and 5/16 in. dia. carriage bolts and nuts; bands at 14 in. o.c.
- E. Tops: Equip posts with cast iron or pressed steel non-ornamental top of manufacturer's design.
- F. Gates:
  - 1. Gate Frames: 1-1/2 inch schedule 40 galvanized pipe, 1.900 in. o.d. 2.72 lbs. per foot, welded construction.
  - 2. Internal Bracing: 1-1/4 inch schedule 40 galvanized pipe, 1.660 in. o.d. 2.27 lbs. per foot.
  - 3. Standard-type hinges, heavy malleable iron, constructed to allow gate to swing 90° or 180°.
  - 4. Provide fork latch with padlocking device.
  - 5. Head clearance on tennis court gates shall be 7 ft. with transom panel above.
- G. Fittings: Malleable cast iron or pressed steel, hot-dip galvanized.

CHAIN LINK FENCES - TENNIS COURTS

- H. Windscreen: Tenn-Air Tenn-9 windscreen fabric as manufactured by M. Putterman & Co., (800) 621-0146, 9 ft. in height, or an approved equivalent product.
  - 1. 10 oz. 100% coated polyester screen with 5-ply reinforced corners and 3-ply reinforced hems with grommets at 12" o.c. and shade factor of 78%. Provide all fasteners and accessories required for a complete installation.
  - 2. Color as selected by Architect from manufacturer's full range.
  - 3. Provide custom logo (100±S.F.). Copy will be supplied by Owner.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Measure and lay out complete fence line, parallel to surface of concrete. Locate line posts at spacings specified. Locate corner posts at positions where fence changes directions more than 10 degrees.

### 3.2 INSTALLATION

- A. General: Install in accordance with Recommendations of USTC and TBA Guide Specifications.
- B. Posts: Set post plumb to 1/4 inch to 10 feet, grout hole to grade level. Crown surface of grout to slope away from posts.
- C. Fence Fabrics:
  - 1. Stretch fabric tight between terminal posts.
  - 2. Position fabric on inside of tennis court framing with bottom of fabric 3/4 in. plus or minus 1/4 in. above court surface.
  - 3. Cut fabric to form one continuous piece between terminal posts.
  - 4. Attach fabric to terminal post using tension bars and tension bands at 14 in. o.c.
  - 5. Attach fabric to line posts using wire ties or clips, spacing not to exceed 15 in. o.c.
  - 6. Attach fabric to top, bottom and middle rails using wire ties or clips, spacing not to exceed 24 in. o.c.
- D. Gates: Install gates plumb and level, 1/4 in. in 10 ft. Adjust hardware to provide smooth operation.
- E. Windscreen: Install in strict compliance with manufacturer's instructions and recommendations.

### 3.3 ADJUST AND CLEAN

- A. Adjust brace rails and tension rods for rigid installation. Tighten hardware, fasteners and accessories. Remove excess and waste materials from project site.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Ornamental metal fencing.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Include construction details, materials descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: Show locations of fences, post, rails, and accessories. Include plans, fence elevation, sections, details of post anchorage, and other required installation clearances.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed ornamental metal fences and gates similar in material, design, and extent to those indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

1.4 PRODUCT HANDLING AND STORAGE

- A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism, and theft.

1.5 WARRANTY

- A. Warrant the work specified herein for 20 years against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship. Include a 5 year labor warranty. Defects shall include, but not limited to, the following:
  - 1. Cracking
  - 2. Peeling
  - 3. Blistering
  - 4. Corroding
  - 5. Failure of mechanical parts or assemblies

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide Montage II, Majestic 3-rail ornamental metal fencing system as manufactured by Ameristar Fence Products, Inc., (phone 800.321.8724 web site: [www.ameristarfence.com](http://www.ameristarfence.com)).

2.2 MATERIALS

- A. Materials for fence framework (i.e., pickets, rails, and posts) shall be manufactured from coil steel having a minimum yield strength of 50,000 psi. The steel shall be galvanized to meet the requirements of ASTM A 526 with a minimum zinc coating weight of 0.90 ounces per square foot (coating Designation G-90), hot-dip process. Galvanized framework shall be subject to a six stage pretreatment/wash (with zinc phosphate) followed by "PERMACOAT™", an electrostatic spray application of a two-coat powder system. Color shall be as selected by Architect. Members as follows:
  - 1. Posts: 3" square x 12 gage steel tube posts with flat cap.
  - 2. Pickets: 1" square x 14 gage steel tube pickets spaced with air gap not to exceed 4 inches.

3. Rails: 1-3/4" x 1-3/4" x 12 gage rails, (2) at top of fence panel and (1) near bottom of panel as shown by Drawings.

## 2.3 FABRICATION

- A. Pickets, rails, and posts shall be precut to specified lengths. Ornamental metal fence shall be factory-fabricated in sections.
- B. All components of ornamental metal fence shall be factory finished after fabrication.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Stake locations of fence lines and terminal posts. Indicate locations of utilities, lawn sprinkler system, and underground structures.

### 3.2 INSTALLATION

- A. General: Install ornamental metal fences in strict compliance with manufacturer's written instructions and recommendations.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings as recommended by manufacturer.
- C. Post Setting: Set posts in concrete.
  1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete.
  2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter. Extend concrete 2 inches above grade; shape and smooth to shed water.
- D. Panels shall be attached to posts using panel brackets and bolt-on hardware supplied by manufacturer.

### 3.3 CLEANING

- A. Contractor shall clean the jobsite of excess materials; post hole excavations shall be scattered uniformly away from posts.

END OF SECTION

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping, valves, sprinklers, specialties, controls, and wiring for automatic control irrigation system.

1.2 DEFINITIONS

- A. Lateral Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Irrigation Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

1.3 SUBMITTALS

- A. Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:
  - 1. System valves.
  - 2. Specialty valves.
  - 3. Control-valve boxes.
  - 4. Sprinklers.
  - 5. Irrigation specialties.
  - 6. Controllers as specified.
  - 7. Backflow Preventers.
- B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. As indicated on the drawings & Cy-Fair ISD Standards

### 2.2 PIPES, TUBES, AND FITTINGS

- A. Piping – Schedule 40 for 1" - 3"; no class 200. Mainline campus and athletic fields, 4" class 200 gasketed, unless stated otherwise. Bed in 4" line with sand and tamp.
- B. Fittings—Schedule 80 for all fittings on pressure side of valve and schedule 40 nipple on the lateral side. No 45-degree ells.
- C. Fittings—Use 2" schedule 80 12" nipples threaded in place of male adapters on zone valves.
- D. Swing Joints- Use IPS PVC Flex Hose w/ Weld-On 795 PVC Clear Transparent Glue for the standard schedule 40 fittings. (No "poly pipe"). Provide Teflon tape on all threaded connections except heads.
  - 1. Spray bodies / 3500 Rotors use 1/2" flex.
  - 2. RB 5000 Rotors use 3/4" flex.
  - 3. Falcon Rotors use 1" flex.
  - 4. \*\*Minimum of 2 feet from lateral to head.

### 2.3 Valves / Valve Boxes

- A. PVC Ball Valves: MSS SP-122, nonunion type, with full-port ball, socket or threaded detachable end connectors, and pressure rating not less than 150 psi.
- B. Rainbird PEB (Use only 1" or 2" valves / no 1 1/2" valves)
- C. PE-IVM valve for 2-wire system.
- D. Isolation valve—Brass Gate Valve
- E. Quick Coupler – Hunter HQ-5RC-B, with Keys & Swivels.
- F. Valve Box – NDS Rectangular 14" X 19" Overlapping Cover – ICV Green/Green (Model 314C) – NO ROUND BOXES.
- G. Set top of lid box flush to finish grade

### 2.4 SPECIALTY VALVES

- A. Plastic Automatic Control Valves: Molded-plastic body, normally closed, diaphragm type with manual flow adjustment, and operated by 24-V ac solenoid.

1. Manufacturer as indicated on the drawings.

B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 1 inch maximum.

## 2.5 SPRINKLERS

A. Description: Plastic housing and corrosion-resistant interior parts designed for uniform coverage over entire spray area indicated, at available water pressure.

1. Manufacturer as indicated on the drawings.

2. Sprinkler heads - Each type of head shall be the product of Rainbird Corp. – NO SUBSTITUTIONS

a. Rainbird Spray head – Rainbird VAN 1806

b. Shrub head – Rainbird 1812 high pop SAM / PRS

c. Bubbler head – Use 1806 body w/ Hunter Bubbler nozzle

d. Rotor Head – Rainbird 3500 SAM / PRS

e. Rotor head – Rainbird 5000 5004 Plus SAM / PRS

f. Rotor head - Athletic Field applications Rainbird Falcon (Stainless Steel) with a #26 nozzle.

## 2.6 AUTOMATIC-CONTROL SYSTEM

A. Traditional Wire System – LXME2 Traditionally-Wired Controller, 48-Stations, with IQ4G-USA Cartridge

B. Two Wire System - ESP-LXIVM 2-Wire Decoder Controller, 60-Stations, with IQ4G-USA Cartridge

C. All new systems need power cutoff at controller.

D. Include Rain/Freeze Sensor WR2RFC

E. Include a master valve and flow sensor sized and located properly for system: Rainbird ultrasonic sensor, model UFC 200 or Netafim combination master valve and flow sensor. Installed per the manufacturer, shielded wire must be used and cannot share master valve wiring or ports on module in the controller.

F. Multi- strand wire to be used to connect 14 Ga. Field wire to controller, or shielded wire when required.

G. Confirm controller location during pre-con meeting.

## 2.7 Drip Line

A. Manufacturer as indicated on the drawings.

B. Only in required areas.



2.8 Primer / Glue

- A. Christy's Purple Primer / Christy's Red Hot Blue for 4" and smaller.

2.9 Backflow Preventers

- A. Install back flows using galvanized pipe, from main line including elbows to back flow; also freeze protect and cage back flow on concrete slab.
- B. PVB (1st preference) Watts 800M4 (Provide Freeze Protection Insulation).
- C. 2" reduced principle device (RP) Febco 860
- D. 2" double check (DC) Febco 850
- E. 3" and larger sizes, ASP (RPZ) Wilkins 375
- F. 3" and larger sizes, ASP, double check (DC) Wilkins 350

PART 3 - EXECUTION

3.1 EARTHWORK

- A. NOT USED.
- B. Install piping and wiring in sleeves under sidewalks and paving per the drawings.
- C. Provide minimum cover over top of underground piping according to the following:
  - 1. Irrigation Main Piping: Minimum depth of 18 inches.
  - 2. Lateral Piping: 12 inches.
  - 3. Sleeves: 18 inches.

3.2 PIPING APPLICATIONS

- A. Underground Irrigation Main Piping: Schedule 40 PVC pipe and Schedule 80 socket fittings (Schedule 80 for all fittings on pressure side of valve and schedule 80 nipple on the lateral side; Schedule 40 for all fittings on non-pressure side of valve); and solvent-cemented joints per the drawings.
- B. Lateral Piping: Schedule 40 PVC pipe and socket fittings (Schedule 80 for all fittings on pressure side of valve and schedule 80 nipple on the lateral side; Schedule 40 for all fittings on non-pressure side of valve) per the drawings and details.
- C. Sleeves – Sch. 40 PVC / 4-6" – Embedded brass pin to mark location on sidewalk or curb. Extend sleeve 24" beyond the edge of the pavement and turn up. Cap sleeve at finish grade.

### 3.3 VALVE APPLICATIONS

- A. Control Valves: Per the drawings.

### 3.4 INSTALLATION

- A. Install piping free of sags and bends.
- B. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- C. Install fittings for changes in direction and branch connections.
- D. Install unions adjacent to valves and to final connections to other components.
- E. Lay piping on solid base, uniformly sloped without humps or depressions.
- F. Control Valves: Install in control-valve box.
  - 1. Use schedule 80 nipple on each side of valve 12" minimum length. Brass gate valves preferred.
  - 2. Valves located no closer than 24" to the main. Only one valve per valve box.
  - 3. Valve depth should be so that the valve box lid is flush with the ground (valve no deeper than 12-18" from ground level.
  - 4. 4" of pea gravel in the bottom of valve boxes.
  - 5. Junction box for wires separate from valve boxes.
- G. Flush circuit piping with full head of water and install sprinklers after hydrostatic test is completed.
- H. Locate sprinkler heads to maintain a minimum distance of 2 inches from paved surfaces.
- I. Install freestanding controllers on precast concrete bases per the drawing.
- J. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas if irrigation piping is installed in sleeve.
- K. Football / Soccer Field – Locate valves in back of end zones, aligned with zone. Center feed the laterals toward the middle of the field. Head to head coverage. Isolate each field without shutting the entire IR down. Brass gate valves preferred.
- L. CFISD Installation Comments:
  - 1. Main Lines-- with at 18" depth and laterals at 12" depth.
  - 2. If multiple lines are installed in the same trench, then main line shall be install at the bottom with minimum of 3" coverage of backfill material for separation prior to installing laterals.
  - 3. Place locate wire throughout the main line trench / ditch.
  - 4. If main line or laterals are in same sleeve as wires, the wires will need their own sleeve. Shielded wire to be run separately from zone valve wires.

5. All piping de-burred prior to permanent glue being applied.
6. Trees—Bubblers
7. Backfill Material —at least 2" of rock free sand or soil surrounding pipe.
8. Set Lawn Heads, (adjacent to walks, curbs, etc...), to grade at 6"-8" off existing pavement.
9. Renovations – all existing irrigation systems to be demonstrated and video documented prior to commencement of construction. Prior to trenching/excavation ask owner for assistance in locating any known irrigation lines. Owner and contractor shall demonstrate irrigation system prior to any work starting and afterward work is completed.
10. Junction Box- For wires separate from valve boxes, not housed in or with zone valves. Leave 2 feet of wire length when spliced. Use 3M DBY connectors for all splices.
11. Zone Valve Installation- Valves located no closer than 24" to the main. Only one valve per valve box. Valve depth should be so the valve box lid is flush with the ground. (valve no deeper than 12" from ground level). 14ga wire size red/white, yellow for tree bubbler zones.
12. Controller to Zone Valve- Each zone, prior to ditch cover up, must be checked and verified with Cy Fair irrigators to have a resistance reading of between 32 and 60 ohms.
13. Water Window- Not to exceed 6 hours for campus and fields.

### 3.5 FIELD QUALITY CONTROL

#### A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Notify owner 24 hours in advance for inspections.
  - a. Mainline inspection prior to cover up.
  - b. Lateral line inspection prior to cover up.
  - c. Pressure test main line with 100 PSI for 2 hours. Check for leaks. Provide findings no later than the end of schematic design and provide to owner.
  - d. Valve inspection.
  - e. Leaks resulting from tests shall be repaired and tests repeated until system passes.
  - f. Failure to have the system or part of the system inspected and approved by CFISD irrigation technician will result in the contractor having to re-expose lines for inspection.

#### B. Final Acceptance / Walk:

1. Provide three half size drawing sets of Irrigation As-Built Plans/Installer's drawings and a laminated zone chart description for the controller.
2. Demonstration of all zones.
3. Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work and "punch list" items generated by Substantial Completion and Final Inspection reviews, but exclusive of Contractor obligations under warranty.
4. Acceptance will include a 2 hour Owner orientation session with Contractor and Owner/operator.

5. Contractor shall provide Record Drawing showing accurate locations of valves, meters, vacuum breakers, controllers and mainline, general layout of sprinkler heads, sprinkler zoning, controller location. Locations shall be indicated and dimensioned from easily identifiable and permanent features such as buildings, curbs, fences, walkways, or property lines. This Record Drawing shall be provided to Owner as noted above.
  6. Provide a copy of the backflow preventer test as performed by a licensed Backflow Technician.
  7. General Contractor maintenance shall begin immediately after system is installed and continue until Owner acceptance/substantial completion. Maintenance shall include all watering operations (including hand and temporary), monitoring, adjustments to watering schedule, head adjustments and/or replacements, etc.
- C. Remove and replace units and re-inspect as specified above.
- D. Arrange valve stations to operate in a way to view progressive sequence. Record sequence on controller door. Provide payouts during construction documentation for CFISD approval.

3.6 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers so they will be flush with, or not more than 1/2 inch above, finish grade.

END OF SECTION 32 84 00



SECTION 32 91 13.13

TOPSOIL PLACEMENT AND GRADING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. Payment for topsoil is on a cubic yard basis.
  - 2. Payment for grading shall be incidental to the project unless included on the bid form.
- B. 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

SECTION 32 92 13

HYDRO-MULCHING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Seeding, fertilizing, mulching, and maintenance in areas other than designated athletic fields.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:  
1. Payment for Hydro-mulch is on a per acre basis.
- B. 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 certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.
- C. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil: Conform to material requirements of Division 32.
- B. Seed: Conform to U.S. Department of Agriculture rules and regulations of Federal Seed Act and Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:
1. Rye: Fresh, clean, Italian rye grass seed (*lolium multi-florum*), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.
  2. Bermuda: Extra-fancy, treated, lawn type common bermuda (*Cynodon dactylon*). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.
  3. Wet, moldy, or otherwise damaged seed will not be accepted.
  4. Seed requirements, application rates, and planting dates are:

TYPE	APPLICATION RATE POUNDS/A	PLANTING DATE
Hulled Common Bermuda Grass 98/88	40	Jan 1 to Mar 31
Unhulled Common Bermuda Grass 98/88	40	
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda Grass 98/88	40	Oct 1 to Dec 31
Unhulled Common Bermuda Grass 98/88	40	
Annual Rye Grass (Gulf)	30	

- C. Fertilizer: Dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers which bear manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of following elements:



1. Nitrogen: 10 Percent
2. Phosphoric Acid: 20 Percent
3. Potash: 10 Percent

D. Mulch:

1. Virgin wood cellulose fibers from whole wood chips having minimum of 20 percent fibers 0.42 inches in length and 0.01 inches in diameter.
2. Cellulose fibers manufactured from recycled newspaper and meeting same fiber content and size as for cellulose fibers from wood chips.
3. Dye mulch green for coverage verification purposes.

E. Soil Stabilizer: "Terra Tack 1" or approved equal.

F. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Place and compact topsoil in accordance with requirements of Division 32.
- B. Dispose of Objectionable and Waste Materials in accordance with Division 1.

#### 3.2 APPLICATION

- A. Seed: Apply uniformly at rates given in Paragraph 2.01 B for type of seed and planting date.
- B. Fertilizer: Apply uniformly at rate of 500 pounds per acre.
- C. Mulch: Apply uniformly at rate of 50 pounds per 1000 square feet.
- D. Soil Stabilizer: Apply uniformly at rate of 40 pounds per acre.
- E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydro mulching.
- F. Sod: Lay single row of sod along perimeter where top soil and pavement intersect. Apply in conformance to Division 32.
- G. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Owner's Representative approval before resuming operations.

#### 3.3 MAINTENANCE

- A. Maintain grassed areas minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in fall, continue maintenance following spring until acceptable lawn is established.
- B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.
- C. Repair areas damaged by erosion by regrading, rolling and replanting.
- D. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydro mulch.
- E. Mow grass when height reaches 3 1/2 inches or greater on average before final acceptance. Mow to height of 2 1/2 inches.

END OF SECTION

SECTION 33 05 13

MANHOLES AND STRUCTURES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. Payment is on a unit price basis for each manhole and structure installed.
- B. 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 (Non-shrink)
- 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. Internal liquid 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 recompact, 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 subgrades 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 of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.
- B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.
- C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.
- D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.
- E. Test connection for watertight seal before backfilling.

### 3.6 INVERTS FOR SANITARY SEWERS

- A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
  - 1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum
  - 2. Depth of bench to invert:
    - a. Pipes smaller than 15 inches: one-half of largest pipe diameter

- b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter
- c. Pipes larger than 24 inches: equal to largest pipe diameter
- 3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

- B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

### 3.7 DROP CONNECTIONS FOR SANITARY SEWERS

- A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of four (4) inches outside bells.
- B. Install drop connection when sewer line enters manhole higher than 30 inches above invert of manhole.

### 3.8 STUBS FOR FUTURE CONNECTIONS

- A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

### 3.9 MANHOLE FRAME AND ADJUSTMENT RINGS

- A. Combine precast concrete adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.
- B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.
- C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner 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

SECTION 33 05 13.13

MANHOLE GRADE ADJUSTMENT

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for the adjustment of a proposed manhole is incidental to the installation of the manhole.
  - 2. Payment for the adjustment of an existing manhole is on a unit price basis for each existing manhole adjusted.
- B. 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 CONCRETE MATERIALS

- A. Provide concrete, conforming to requirements of Division 33.
- B. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Division 33.
- C. Provide mortar conforming to requirements of City of Houston Standard Specifications Section 04016 - Mortar.

2.2 CAST-IRON MATERIALS

- A. Provide cast-iron materials conforming to requirements of Division 33.

2.3 PIPING MATERIALS

- A. For riser pipes and fittings, refer to Division 33.

2.4 MASONRY MATERIALS FOR STORM SEWER MANHOLES AND INLETS

- A. Provide brick masonry units conforming to the requirements of Division 32.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Project Manager.

3.2 ESTABLISHING GRADE

- A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.

### 3.3 ADJUSTING MANHOLES AND INLETS

- A. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in Division 33.
- B. Salvage and reuse cast-iron frame and cover or grate.
- C. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.
- D. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manager's approval.

### 3.4 ADJUSTING VALVE BOXES

- A. Salvage and reuse valve box and surrounding concrete block as approved by Project Manager. No separate pay.
- B. Remove and replace 6 inch ductile iron riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade.
- C. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6 inches telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.
- D. After valve box has been set, aligned, and adjusted so that top lid is level with final grade.

### 3.5 BACKFILL AND GRADING

- A. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Division 31.
- B. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.
- C. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Division 32.

END OF SECTION

SECTION 33 05 16.13

PRECAST CONCRETE UTILITY STRUCTURES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. Payment for precast concrete utility structure is on a unit price basis for each structure installed.
- B. 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

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SECTION 33 05 16.16

CONCRETE FOR UTILITY CONSTRUCTION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. No payment will be made for concrete for utility construction under this Section unless specifically noted in bid documents. Include cost in, unit price for appropriate Work item.
- B. 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 - Standard Specification for Chemical Admixtures for Concrete.
- FF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.
- GG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- HH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- II. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.
- JJ. CRSI MSP-1 - Manual of Standard Practice.
- KK. CRSI - Placing Reinforcing Bars.
- LL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints
- MM. NRMCA - Concrete Plant Standards.

#### 1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit proposed mix design and test data for each type and strength of concrete in Work.
- C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.
- D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Owner's Representative.
- E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

- F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.
- G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

## 1.5 HANDLING AND STORAGE

- A. Cement: Store cement off of ground in well-ventilated, weatherproof building.
- B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.
- C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

## PART 2 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  $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ .
- B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.
- C. Fiber:
  - 1. Fibrillated Polypropylene Fiber:
    - a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
    - b. Physical Properties:
      - 1) Material: Polypropylene
      - 2) Length: 1/2 inch or graded
      - 3) Specific Gravity: 0.91
    - c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.
  - 2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
    - a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
    - b. Physical Properties:
      - 1) Material: Steel
      - 2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1
      - 3) Specific Gravity: 7.8
      - 4) Tensile Strength: 40-400 ksi.
      - 5) Young's Modulus: 29,000 ksi
      - 6) Minimum Average Tensile Strength: 50,000 psi
      - 7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking
- D. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

### 2.2 FORM WORK MATERIALS

- A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of

concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

- B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.
- C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.
- D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.
- E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

### 2.3 PRODUCTION METHODS

- A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

### 2.4 MEASUREMENT OF MATERIALS

- A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.
- B. Measure water and liquid admixtures by volume.

### 2.5 DESIGN MIX

- A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.
- B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Owner's Representative for review.
- C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Owner's Representative.

- D. Classification:

Class	Type	Minimum Compressive Strength (LBS/Sq.In.)		Maximum 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.

- E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.
- F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

- G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

## 2.6 PVC WATERSTOPS

- A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.
- B. Flat Strip and Center-Bulb Waterstops:
1. Thickness: not less than 3/8 inch
  2. Acceptable Manufacturers:
    - a. Kirkhill Rubber Co., Brea, California
    - b. Water Seals, Inc., Chicago, Illinois
    - c. Progress Unlimited, Inc., New York, New York
    - d. Greenstreak Plastic Products Co., St. Louis, Missouri
    - e. Approved equal.

## 2.7 RESILIENT WATERSTOP

- A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.
- B. Bentonite Waterstop:
1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
  2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
  3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch
  4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.
- C. Adhesive Waterstop:
1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
  2. Meets or exceeds requirements of Federal Specification SS-S-210A.
  3. Supplied wrapped completely by 2 part protective paper.
  4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.
  5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.
  6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved equal.

## EXECUTION

### 2.8 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.

## 2.9 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.

## 2.10 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 through 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.

## 2.11 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.

#### 2.12 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 end temperature is 35 degrees waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

#### 2.13 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.

## 2.14 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.

## 2.15 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.

## 2.16 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.



## 2.17 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.

## 2.18 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.

## 2.19 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.

## 2.20 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

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SECTION 33 06 10.14

POLYVINYL CHLORIDE (PVC) PIPE

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.
- B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 48 inches.
- C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No separate payment will be made for PVC pipe under this section. Include cost in unit price for work included as specified in the following sections:
    - a. Section 33 11 00 – Water Utility Distribution Piping
    - b. Section 33 31 00 – Sanitary Utility Sewerage Piping
    - c. Section 33 31 00.11 – Sanitary Sewage Force Mains
- B. 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. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.
- B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
- C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

- L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
- O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water.
- P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.
- R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.
- S. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.
- T. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.
- U. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

#### 1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

#### 1.5 QUALITY CONTROL

- A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.
- B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.
- C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Owner's Representative for review. Cost of testing paid by Contractor.

### PART 2 PRODUCTS

#### 2.1 MATERIAL

- A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.
- B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids,

cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

- C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.
    - 1. Pipe Material:
      - a. DR 18: For restrained joints where shown on Drawings.
      - b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.
  - D. Water Service.
    - 1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
    - 2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).
  - E. Gaskets:
    - 1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
    - 2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
    - 3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.
  - F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.
  - G. Do not use PVC in potentially or known contaminated areas.
  - H. Do not use PVC in areas exposed to direct sunlight.
- 2.2 WATER SERVICE PIPE
- A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.
  - B. Pipe 14 inch through 20 inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.
  - C. Provide Polyvinyl Chloride Pipe from approved manufacturers.
  - D. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Owner's Representative.
  - E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

## 2.3 GRAVITY SEWER PIPE

- A. All PVC gravity sanitary sewer 5' beyond building, 6" or smaller to be schedule 40, all other sanitary sewer pipe shall be in accordance with provisions in the following table:

Wall Construction	Manufacturer	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
Solid	J-M Pipe	D3034	SDR 26 / PS 115	8" to 10"
	Certain Teed	D3034	SDR 35 / PS 46	12" & 15"
	Diamond	F679	SDR 35 / PS 46	18" to 27"
	Uponor ETI	AWWA C900	DR 18 / N/A	4" to 12"
	North American	AWWA C909	DR 18 / N/A	4" to 12"
		AWWAC905	DR 18 / N/A	14" to 16"
Truss (Gasketed)	Contech	D2680	N/A / 200 psi	8" to 15"
Profile	Contech A-2000	F949	N/A / 46 psi	12" to 36"
	Contech A-2026	F949	N/A / 115 psi	8" to 10"
	ETI, Ultra-Rib	F794	N/A / 46 psi	8" to 30"
	ETI, Ultra-Corr	F794	N/A / 46 psi	24" to 36"

- B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.
- C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.
- D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.
- E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.
- F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner's Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.
- G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.
- H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.
- I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.
- J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

## 2.4 SANITARY SEWER FORCE MAIN PIPE

- A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Division 33.
- B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.
- C. Fittings: Provide approved ductile iron fittings as per Division 33, except furnish fittings with one of following approved internal linings:
  - 1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting
  - 2. Nominal 40 mils (35 mils minimum) polyurethane
  - 3. Nominal 40 mils (35 mils minimum) ceramic epoxy
  - 4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy
- D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Division 33.
- E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

## 2.5 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

- A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).
- B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

# PART 3 EXECUTION

## 3.1 PROTECTION

- A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer's recommendations.

## 3.2 INSTALLATION

- A. Conform to requirements of Division 33, as applicable.
- B. Install PVC pipe in accordance with Division 33, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.
- C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:
  - 1. Water service pipe 12 inches in diameter and smaller 4 feet of cover.
  - 2. Water service pipe 16 inches in diameter and larger 5 feet of cover.
- D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.
- E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.
- F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.
- G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

## 3.3 PVC RESTRAINED MECHANISM



- A. Do not apply lubricant to spline or pipe or coupling spline grooves.
- B. Do not use excessive force while inserting the spline through coupling.
- C. Insert spline until it is fully seated around circumference of pipe.
- D. Field Cutting of Pipe Ends:
  - 1. Perform by workers certified by manufacturer.
  - 2. Use a PVC pipe cutter and provide square ends.
  - 3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION

SECTION 33 06 40.10

HDPE SOLID AND PROFILE WALL PIPE

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. No separate payment will be made for HDPE pipe under this Section. Include cost in unit prices for work, as specified in the following sections:
    - a. Section 33 41 00 - Storm Utility Drainage Piping.
- B. 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	18"–120"

### 2. REHABILITATION CONSTRUCTION PIPE PRODUCTS SLIPLINING OF SANITARY SEWER

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE
02550	Solid Wall Poly	Chevron Plexco Quail Poly Pipe AmeriFlow by NAPCO Ameriflow by KWH	F-714	DR 21	46	8" – 48" 3" – 12" 14" – 63"
02550	Polyethylene Profile Wall	Spirolite	F-894	n/a	46	18"–120"

B. For Storm Sewer and Residential Driveway Culverts provide HDPE as follows:

1. N-12 and N-12 HC by Advanced Drainage Systems, Inc. (ADS).
2. Sure-Lok F477 by Hancor, Inc.

C. Furnish solid wall pipe with plain end construction for heat joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce fused leak-free joint.

D. Furnish profile-wall gravity sewer pipe with bell-and-spigot end construction conforming to ASTM D 3212. Joining will be accomplished with elastomeric gasket in accordance with manufacturer's recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, elastomeric gasket, contained in machined groove on pipe spigot, is compressed radially in pipe bell to form positive seal. Design joint to avoid displacement of gasket when installed in accordance with manufacturer's recommendations.

E. Furnish solid wall pipe for sanitary sewer force mains with minimum working pressure rating of 150 psi, and with inside diameter equal to or greater than nominal pipe size indicated on Drawings.

F. Furnish corrugated polyethylene pipe (CPP) for gravity storm sewer pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line. Suitable joints are:

1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged conforming to the requirements of ASTM F-477.

G. Jointing:

1. Gaskets:

- a. Meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.
- b. Pipes allowed to be installed in potentially contaminated areas, where free product is found near elevation of proposed sewer, shall have the following gasket materials for noted contaminants:

Contaminant	Gasket Material Required
Petroleum (diesel, gasoline)	Nitrile Rubber
Other contaminants	As recommended by pipe manufacturer

2. Lubricant. Use lubricant for assembly of gasketed joints which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.2 MATERIALS FOR SANITARY SEWER

- A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting requirements of cell classification in accordance with ASTM D 3350 are also suitable for making pipe products under these specifications.
- B. Other Pipe Materials: Materials other than those specified in Paragraph 2.02A, Pipe and Fittings, may be used as part of profile construction, e.g., as core tube to support shape of profile during processing, provided that these materials are compatible with base polyethylene material and are completely encapsulated in finished product and in no way compromise performance of pipe products in intended use. Examples of suitable material include polyethylene and polypropylene.

2.3 MATERIALS FOR STORM SEWERS AND RESIDENTIAL DRIVEWAY CULVERTS

- A. Pipe and Fittings: High density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in AASHTO M 294, AASHTO MP7 and ASTM D 3350.
- B. Types: CPP shall meet one or both of following:
  1. Type S: Outer corrugated wall with smooth inner liner.
  2. Type D: Inner and outer smooth walls braced circumferentially or spirally with projections or ribs.
- C. Lubricant: Use lubricant for assembly of gasketed joints, which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.4 TEST METHODS FOR SANITARY SEWER

- A. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner's Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.
- B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.05A, in suitable press until internal diameter has been reduced to 40 percent of original inside diameter of pipe. Rate of loading shall be uniform and at 2 inches per minute. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles.

- C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace shear load transfer bars and supports with 6-inch-wide support blocks that can be either flat or contoured to conform to pipe's outer contour.
- D. Purpose of Tests. Flattening and joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

## 2.5 TEST METHODS FOR STOMR SEWERS AND RESIDENTIAL DRIVEWAY CULVERTS

- A. Pipe stiffness at 5 percent deflection, when determined in accordance with ASTM D 2412, shall be as specified in Section 7.4 of AASHTO M 294.
- B. Minimum inner wall thickness shall be as specified in Section 7.2.2 of AASHTO M 294.

## 2.6 MARKING

- A. Mark each standard and random length of pipe in compliance with these Specifications with following information:
  - 1. Pipe size.
  - 2. Pipe class.
  - 3. Production code.
  - 4. Material designation.

# PART 3 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

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SECTION 33 06 40.11

REINFORCED CONCRETE PIPE

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Reinforced concrete pipe for storm sewers.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No separate payment will be made for HDPE pipe under this Section. Include cost in unit prices for work, as specified in the following sections:
    - a. Section 33 41 00 - Storm Utility Drainage Piping.
- B. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

- A. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- B. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe.
- C. ASTM C 497 - Method of Testing Concrete Pipe, Sections, or Tile.
- D. ASTM C 506 - Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.
- E. ASTM C 507 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
- F. ASTM C 655 - Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.
- G. ASTM C 822 - Standard Definitions and Terms Relating to Concrete Pipe and Related Products.
- H. ASTM C 877 - Standard Specification for External Sealing Bands for Non circular Concrete Sewer, Storm Drain, and Culvert Pipe.

1.4 SUBMITTALS

- A. Submittals shall conform to requirements in Division 1.
- B. Submit complete product data for pipe, fittings and gaskets for approval. Indicate conformance to appropriate reference standards.
- C. Submit certificates by a testing laboratory, hired and paid by the manufacturer, that concrete pipes meet applicable standards when tested in accordance with ASTM C 497.

PART 2 PRODUCTS

2.1 REINFORCED CONCRETE PIPE

- A. Circular reinforced concrete pipe shall conform to requirements of ASTM C 76, for Class III wall thickness. Joints shall be rubber gasketed conforming to ASTM C 443.
- B. Reinforced concrete arch pipe shall conform to the requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.



- C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to the requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Joints shall be rubber gaskets conforming to ASTM C 877.
- D. Reinforced concrete D-load pipe shall conform to the requirements of ASTM C 655.

## 2.2 GASKETS

- A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.
- B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by the pipe manufacturer

## 2.3 SOURCE QUALITY CONTROL

- A. Representatives of Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Conform to requirements of the following Sections, as applicable:
  - 1. 33 41 00 - Storm Utility Drainage Piping
- B. Install reinforced concrete pipe in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Installation of water lines.
- B. Specifications identify requirements for both small diameter water lines and large diameter water lines. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for water utility distribution piping will be by type and size on a linear foot basis.
- B. 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. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings
- B. ANSI/NSF Standard 61 - Drinking Water System -Health Components
- C. ASTM A 36 - Standard Specification for Carbon Structural Steel
- D. ASTM A 536 - Standard Specification for Ductile Iron Castings
- E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes
- G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes
- H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar
- I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.
- J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination
- K. ASTM E 709 - Standard Guide for Magnetic Particle Examination
- L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe
- M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe
- N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Conform to submittal requirements of applicable Section for type of pipe used.

- C. Photographs: Submit photographs conforming to requirements of Division 1 prior to commencement of construction.
- D. Submit videotapes conforming to requirements of Division 1, if applicable.
- E. Submit Lone Star notification transmittal number prior to beginning excavation.
- F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:
  - 1. Disinfection; not to exceed 4,000 linear feet per section.
  - 2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.
  - 3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

## PART 2 PRODUCTS

### 2.1 PIPE MATERIALS

- A. Install pipe materials which conform to Division 33.
- B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.
- C. Type of pipe materials used is Contractor's option unless specifically identified on Drawings.
- D. Provide minimum of 3/8 inch inside joint recess between ends of pipe in straight pipe sections.

### 2.2 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE

- A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.
- B. O-rings: Conform to National Sanitary Foundation requirements.

### 2.3 RESTRAINED JOINTS

- A. Ductile-Iron Pipe: See Division 33.
- B. PVC Pipe: See Division 33. Perform hydrostatic testing in accordance with ASTM F 1674.
- C. Prestressed Concrete Cylinder Pipe, Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.06 D).
- D. Restrained Joints where required on DIP and PVC pipe:
  - 1. Restraint devices: Manufacture of high strength ductile iron, ASTM A 536 up to 24 inches, and ASTM A 36 for sizes greater than 30 inches. Working pressure rating twice that of design test pressure.
  - 2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

### 2.4 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

- A. Flexible (Dresser-type) Couplings.
  - 1. Install where shown on Drawings or where allowed by Owner's Representative for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe

- which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.
- 2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.
- 3. Provide approved flanged adapter couplings for steel pipe.
- 4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of approved coal tar coating.

B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on Drawings.

- 1. Body and Flap: ASTM A 126-B cast iron.
- 2. Seats: ASTM B 21-CA482 or ASTM B 301-CA145 bronze.
- 3. Resilient Seat
- 4. Hinge Arms: ASTM B 584-CA865 high tensile bronze.
- 5. Hinge pins: ASTM B 98-CA655 silicon bronze.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Conform to applicable installation specifications for types of pipe used.
- B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.
- C. Lay pipe to lines and grades shown on Drawings.
- D. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes or separation of four feet minimum from force mains as specified in this Section in all directions unless special design is provided on Drawings.
- E. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from Owner's Representative before proceeding with construction.
- F. Inform Owner's Representative if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Owner's Representative.
- G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing 2 pipe installation crews shall be permitted, unless otherwise approved by Owner's Representative.
- H. Only the appropriate governing agency will handle operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.
- I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.
- J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.
- K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.
- L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Owner's Representative.

### 3.2 HANDLING, CLEANING AND INSPECTION

#### A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.
2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.
3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.
5. Use precautions to prevent injury to pipe, protective linings and coatings.
  - a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
  - b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
  - c. Do not lift pipe using hooks at each end of pipe.
  - d. Do not place debris, tools, clothing, or other materials on pipe.
6. Repair damage to pipe or protective lining and coating before final acceptance.
7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than 6 inches, measured within 15 degrees of line parallel to pipe longitudinal axis of finished pipe, except:
  - a. In surface laitance of centrifugally cast concrete.
  - b. In sections of pipe with steel reinforcing collars or wrappers.
  - c. Within 12 inches of pipe ends.
8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

### 3.3 EARTHWORK

A. Conform to applicable provisions of Division 31.

B. Bedding: Use bedding materials in conformance with Division 31.

C. Backfill: Use bank run sand or earth or native soil as specified in Division 31. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.

E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

### 3.4 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Owner's Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

### 3.5 PIPING INSTALLATION

A. General Requirements:

1. Lay pipe in subgrade free of water.
2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
3. Properly form bedding to fully support bell without wedging or blocking up bell.
4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of Owner's Representative prior to skipping any portion of Work.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Division 33 for additional requirements at critical locations.

E. Laying Large Diameter Water Line

1. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.
2. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Owner's Representative. No additional payment will be made for higher class of pipe or improved bedding.
3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.
4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.
5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.

F. Perform following additional procedures when working on plant sites.

1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Owner's Representative and Water Production personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Owner's Representative agrees key personnel, equipment and materials are on hand to complete Work.
2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.
3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Owner's Representative and the governing agency is present to observe.
4. Coordinate with the governing agency to obtain reduction in operating pressures prior to performing connections to existing piping.

5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Owner's Representative.
  6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Division 1.
  7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
  8. Submit to Owner's Representative Lone Star Notification transmittal number prior to beginning excavation.
  9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.
  10. Provide adequate notice to pipe manufacture's representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.
  11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Division 1.
  12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Owner's Representative by noon on Thursday of week. Contact person must be accessible during weekend, have Houston Metro Area phone number, and be authorized to make emergency decisions.
  13. No night work or plant shut down will be scheduled to begin two working days before or after designated Holidays.
- G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide governing agency a minimum of two weeks notice prior to shutting down existing water line.

### 3.6 JOINTS AND JOINTING

- A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:
1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
  2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
  3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
  4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
  5. Where preventing movement of 16-inch diameter or greater pipe is necessary due to thrust, use restrained joints as shown on Drawings.
    - a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
    - b. Do not include passive resistance of soil in thrust restraint calculations.
  6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Owner's Representative.
- B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:
1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
  2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.
  3. Use galvanized or black nuts and bolts to match flange material. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around

flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.

4. Full length bolt isolating sleeves and washers shall be used with flanged connections. Furnish kits in accordance with City of Houston's "Approved Products List."
5. For in-line flange joints 30 inches in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between 12 inches in diameter and greater and 24 inches in diameter and smaller, provide Phenolic PSI with nitrite seal gasket conforming to ANSI A 21.11 mechanical joint gaskets.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.
2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-inch and smaller.
3. Furnish welded joints with trimmed spigots and interior welds for 36-inch and larger pipe.
4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to 3/4 inch as long as 1 1/2 inch minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 5 degrees.
5. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.
6. Protect coal-tar-epoxy lining during welding by draping an 18-inch-wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.
7. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.
8. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.
9. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.
10. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.
11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.
12. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.
13. Welded Joints for Large Diameter Water Lines:
  - a. Furnish pipe with trimmed spigots and interior welds for 36-inch and larger pipe.
  - b. Use exterior welds for 30 inch and smaller.
  - c. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2 1/2 degrees.
  - d. For large diameter water lines, employ an independent certified testing laboratory, approved by Owner's Representative, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Owner's Representative for review. Owner's Representative has final decision as to suitability of welds tested.
    - 1) Weld acceptance criteria:
      - a) Conduct in accordance with ASTM E165- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for



Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.

b) Examine welded surfaces for the following defects:

- (1) Cracking
- (2) Lack of fusion/penetration
- (3) Slag which exceeds one-third (t) where (t) equals material thickness
- (4) Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width
- (5) Relevant linear indications in which length of linear indication exceeds three times its width
- (6) Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge

14. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimmiing or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.
15. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.
16. Provide cylindrical corrosion barriers for epoxy lined steel pipe 24-inch diameter and smaller, unless minimum wall thickness is 0.5 inches or greater.
  - a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.
  - b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience installing protection fittings.
  - c. All steel pipe is to have cutback 3/4 inch to no greater than 1 inch of internal diameter coating from weld bevel.
  - d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 213.
  - e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Harnessed Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe):

1. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.
2. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum 1/2-inch joint recess. Use joint "diapers" minimum of 12 inches wide.
3. For field adjustments with deflections beyond manufacturer's recommendations:
  - a. Field trim spigot.
  - b. Do not engage ring.
4. Harnessed joints are not permitted in areas defined on Drawings as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.
5. Install harness type joints including snap rings at straight sections of pipe.

E. Restrained Joints

1. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks.
2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of prestressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Owner's Representative. Make adjustments in thrust restraint lengths at no additional cost to Owner.

3. Passive resistance of soil will not be permitted in calculation of thrust restraint.
4. For 16-inch lines and larger use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.
5. Installation.
  - a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
  - b. Examine and clean mechanism; remove dirt, debris and other foreign material.
  - c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
  - d. Verify gasket is evenly seated.
  - e. Do not over stab pipe into mechanism.
6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
7. Place 2500 psi concrete conforming to Division 32, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

F. Joint Grout (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.
2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without rettempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.
3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.
4. Follow established procedures for hot and cold weather concrete placement.
5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.
6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.
7. Interior Joints for Pipe 24 inches and Smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Owner's Representative for 20-inch pipe and smaller.
8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.
9. Remove and replace improperly cured or otherwise defective grout.
10. Strike off grout on interior joints and make smooth with inside diameter of pipe.
11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.
12. Interior Joints for Water Lines 30 inches and Larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Owner's Representative of inside joints before proceeding with next day's

- pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.
13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.
- G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately 1/2 inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to Owner.
- H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Owner's Representative. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.
1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.
  2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
  3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
  4. Replace, repair, or reapply coatings and linings as required.
  5. Assessment of deflection may be measured by Owner's Representative at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
  6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.
- I. Closures Sections and Approved Field Modifications to Steel, Concrete Cylinder Pipe, Bar Wrapped Pipe and Fittings:
1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.
  2. Fill exposed interior and exterior surfaces with nonshrink grout.
  3. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.
  4. For large diameter water lines, provide minimum overlap of 4 inches of butt strap over adjacent piece on butt-strap closures.

### 3.7 CATHODIC PROTECTION APPURTENANCES

- A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.
- B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coating As specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Owner's Representative.
- C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

### 3.8 SECURING, SUPPORTING AND ANCHORING

- A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

- B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).
- C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.
- D. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

### 3.9 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

- A. Double wrap pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.
- B. Do not use polyethylene wrap if pipe is cathodically protected.
- C. Conform to requirements of Division 33.

### 3.10 CLEANUP AND RESTORATION

- A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.
- B. Unless otherwise approved by Owner's Representative, comply with the following:
  - 1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.
  - 2. No later than three days after completing disinfection preparatory work, execute disinfection work.
  - 3. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
  - 4. Do not exceed a total of 50% of total project linear feet of disturbed right-of-way and easement until site is restored in accordance with Division 1.
  - 5. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.
- C. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Division 1. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000 linear feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

### 3.11 CLEANING PIPING SYSTEMS

- A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner's Representative must inspect water line for cleanliness prior to filling.

### 3.12 DISINFECTION OF WATER LINES

- A. Conform to requirements of Division 33.

3.13 FIELD HYDROSTATIC TESTS

- A. Conform to requirements of Division 33.

END OF SECTION

SECTION 33 11 00.10

AUGERING FOR WATER UTILITY DISTRIBUTION PIPING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Installing water service pipe by methods of augering or casing by jacking and boring.
- B. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water mains and large-diameter (greater than 20 inches) water mains. When specifications for large-diameter water mains differ from those for small-diameter water mains, paragraphs for large-diameter mains will govern for large-diameter pipe.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Measurement and payment for pipe installed shall be at the unit price contained in the bid proposal, for each linear foot of pipe installed, complete in place including furnishing of all materials, all equipment, tools, transportation, services, labor and superintendence necessary for the construction and completion of improvements, including fittings; sheeting, bracing, and supporting the adjacent ground of structure where necessary; handling all drainage or ground water; replacing damaged water and sewer service lines, conduits, ducts, etc.; backfilling the trench and pits; removing surplus excavated materials; sterilizing the completed pipelines; replacing street base and surfaces; and other incidentals required to complete the Work.
- B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 DEFINITIONS

- A. Dry Auger Method: Installation of steel casing by excavating soil at the advancing end of casing and transporting spoil through casing by an otherwise uncased auger, while advancing casing by jacking at same rate as auger excavation progresses.
- B. Slurry Auger Method: Installation of casing or pipe by first drilling a small diameter pilot hole from shaft to shaft, followed by reaming the bore to full diameter by augering with slurry, and installing casing or pipe by a pull-back or jacking method.

1.4 REFERENCE STANDARDS

- A. ASTM D 638 - Test Method for Tensile Properties of Plastics.
- B. ASTM D 648 - Test Method for Deflection Temperature of Plastics Under Flexural Load.
- C. ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics.
- D. ASTM D 790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.5 REGULATORY REQUIREMENTS

- A. Conform to Texas State Department of Highways and Public Transportation for installations under state highways. Owner will obtain required permits for State Highway crossings.
- B. Installations Under Railroads:

1. Secure and comply with requirements of right-of-entry for crossing railroad company's easement or right-of-way from railroad companies affected. Comply with railroad permit requirements.
2. Use dry auger method only.
3. No extra compensation for damages due to delays caused by the railroad requesting work to be done at hours which will not inconvenience the railroad.
4. Maintain minimum 35-foot clearance from centerline of tracks.

#### 1.6 SUBMITTALS

- A. Submit product data in accordance with requirements of Section 01 33 00 – Submittal Procedures.
- B. Submit product data for casing insulators for approval.
- C. Prior to commencement of work, furnish for Engineer's approval, a plan showing pit locations, size, depth, and areas for storage, material, and spoil handling. Approval of this plan does not relieve Contractor from responsibility to obtain specified results.
- D. Show actual pit locations dimensioned on as-built drawings so that they can be identified in field.
- E. Submit copy of railroad company permits and rights of entry to Engineer.

#### 1.7 CRITERIA FOR SELECTION OF MATERIAL

- A. Contractor shall be responsible for selection of casing, pipe, and pipe joints to carry anticipated thrust of jacks or loads.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Piping and Fittings: As required by Specification or Drawings.
- B. Casings: Where shown on Drawings, in accordance with Section 33 11 00.10 - Steel Pipe and Fittings.
- C. Casing Spacers: Where casings are shown on Drawings, casing spacer width 8 inches for pipe sizes 4 to 14 inches; 12 inches for pipe sizes 16 to 30 inches.
  1. For welded steel pipe 12 inches and smaller, use Pipeline Seal & Insulator Model PE, or approved equal.
  2. For other pipe materials, use Pipeline Seal & Insulator Model C8G-2 or approved equal for pipe sizes up to 12 inches.
  3. For all pipe sizes above 12 inches, use Pipeline Seal & Insulator Model C12G-2 or approved equal.
- D. Casing End Seals: Provide Pipeline Seal and Insulator Model C, or approved equal.
- E. Casing Spacers (Additional Requirements for Large-Diameter Water Mains): Bolt-on style with shell made of two sections of 14-gauge carbon steel, hot rolled, pickled, and lined with PVC liner, 0.090 inch thick with Durometer A 85-90 overlapping edges to secure liner to spacer; deep embossed flanges for added strength; coated prior to installation of liner and runner with fusion-bonded powder of 14 to 20 mils thickness; electroplated studs, nuts, and washers.
- F. Runners (For Large-Diameter Water Mains): Supported by 10-gauge carbon steel MIG risers welded to shell. Minimum requirements:
  1. Tensile Strength: ASTM D 638; 17,600 psi.
  2. Flexural Strength: ASTM D 790; 25,300 psi.
  3. Compression Strength: ASTM D 695; 18,000 psi.
  4. Deflection Temperature at 264 psi: ASTM D 648; 405 F.

PART 3 EXECUTION

3.1 LIMITS ON AUGER LENGTH

- A. Do not exceed 100 feet for length of auger hole without intermediate pit.
- B. Do not exceed 75 feet for length of auger hole for PVC pipe 12 inches and less in diameter without intermediate pit.
- C. Do not exceed 40 feet for length of auger hole for PVC pipe 14 inches to 24 inches in diameter without intermediate pit.

3.2 PREPARATION

- A. Conform to applicable provisions of Section 31 06 20.17 – Utility Backfill Materials.
- B. Utility Relocations: Relocate utility lines clear of pit and zone of potential significant settlement or other ground disturbance.
- C. Install casings as required by Drawings, in accordance with this Section.
- D. Install temporary solid plug at open end of water main to prevent contamination.

3.3 TRAFFIC CONTROL

- A. Conform to applicable provisions of Section 01570 - Traffic Control and Regulation.
- B. Secure right-of-entry for crossing railroad company's easement or right-of-way.
- C. During construction operations, furnish, and maintain barricades and lights to safeguard traffic and pedestrians, until such time as backfill has been completed and removed from site. Provide additional barricades and lights as directed by Engineer.

3.4 PITS

- A. Construct pits on segments of line and within right-of-way. Locate auger pits where there is minimum interference with traffic or access to property. Do not locate pits close to storm drainage channels, ditches, storm water lines, or culverts. Avoid pit locations near potentially contaminated areas.
- B. Pit Size: Size pits to provide adequate room to meet operational requirements for auger construction as well as any structures indicated on the Drawings. Provide minimum 6-inch space between pipe and walls of bore pit. Maximum allowable width of pit shall be 5 feet. Width of pit at surface shall not be less than at bottom. Maximum allowable length of pit shall be no more than 5 feet longer than one full joint of pipe and shall not exceed 25 feet.
- C. Excavate bore pits to finished grade at least 6 inches lower than grade indicated by stakes.
- D. Backfill in accordance with Section 31 06 20.17 – Utility Backfill Materials.
- E. Auger pits that are excavated and backfilled as part of open-cut water line construction shall be in accordance with Section 31 06 20.17 – Utility Backfill Materials.
- F. The provisions for safety protection against traffic, and accidental or unauthorized entry, as specified in Section 02445 - Tunnel Shafts, shall be followed in applicable situations.
- G. Install sheeting, lining, shoring, and bracing required for protection of the workmen and the public in accordance with Section 01 35 26 - Trench Safety Systems.

3.5 AUGERING (BORING)



- A. Auger from approved pit locations. Excavate for pits and install shoring as outlined above under Paragraph 3.7, Pits. Auger mechanically with use of a pilot hole entire length of crossing and check for line and grade on opposite end of bore from work pit. The large hole is to be no more than 2 inches larger than diameter of bell. Place excavated material outside working pit and dispose of as specified. Use water or other fluids in connection with boring operation only to lubricate cuttings; jetting is not permitted.
- B. In unconsolidated soil formations, a gel-forming colloidal drilling fluid may be used. Fluid is to consist of at least 10 percent of high-grade processed bentonite and shall consolidate cuttings of bit, seal walls of hole, and shall furnish lubrication for subsequent removal of cuttings and installation of pipe.
- C. Depending on the character of the soil encountered during the augering operation, conduct operations without interruption, insofar as practical, to prevent the hole from collapsing or the pipe from seizing up in the hole before the installation is complete.
- D. Allowable variation from line and grade shall be as specified under Paragraph 3.07, Jacking Casing.
- E. Remove and replace any pipe damaged in augering operations.

### 3.6 FILLING ANNULAR SPACE

- A. For installation of water main, block void space around pipe in augered hole with approximately 12 inches of packed clay or approved equal material to prevent bedding or backfill from entering the void around the pipe in the augered hole when compacted. For pipe diameters 4 inches through 8 inches use minimum 1/2-cubic-foot clay; for pipe diameters 12 inches through 16 inches use minimum 3/4-cubic-foot clay.

### 3.7 JACKING CASING

- A. Comply with Section 01 35 26 - Trench Safety Systems for all pits, access shafts, end trenches, and other excavations relating to work required by specifications. Dewater as required to provide safe working conditions.
- B. If grade of casing at jacking end is below ground surface, excavate pits or trenches for conducting jacking operations and for placing end joints of casing. Wherever end trenches are cut into sides of embankment or beyond it, sheath securely and brace such work to prevent earth caving.
- C. Make up only one joint at a time in pit or trench prior to jacking.
- D. Do not interfere with operation of railroad, street, highway, or other facility, nor to weaken or damage embankment or structure.
- E. Use heavy-duty jacks sized for forcing casing through embankment. Use appropriate jacking head, usually of timber, and bracing between jacks and jacking head and jacking frame or backstop. Apply jacking pressure uniformly around ring of casing. Set casing to be jacked on guides, properly braced together, to support section of casing and to direct it in proper line and grade. Place jacking assembly in line with direction and grade of casing. Excavate embankment material just ahead of casing and remove material through casing. Force casing through embankment with jacks into excavated auger hole.
- F. Conform excavation for underside of casing to contour and grade of casing, for at least one third of circumference of casing. Provide clearance of not more than 2 inches for upper half of casing. Taper off upper clearance to zero at point where excavation conforms to contour of casing.
- G. The excavation may extend beyond end of casing depending on character of material, but shall not exceed 2 feet in any case. Decrease advance excavation at the direction of the Engineer, if character of material being excavated makes it desirable to keep advance excavation closer to end of casing.
- H. Jack casing from low or downstream end. Lateral or vertical variation in final position of casing from line and grade as shown on Drawings will be permitted only to extent of 1 inch in 10 feet, provided such variation is regular and only in one direction and that final grade of flow line is in direction indicated on Drawings.

- I. Use cutting edge of steel plate around head end of casing extending short distance beyond end of casing with inside angles or lugs to keep cutting edge from slipping back onto casing.
- J. Once jacking of casing is begun, carry on without interruption, insofar as practicable, to prevent casing from becoming firmly set in embankment.
- K. Remove and replace any casing damaged in jacking operations.
- L. Backfill pits or trenches excavated to facilitate jacking operations immediately after completion of jacking of casing.
- M. Grout annular space between casing and excavated hole when loss of embankment occurs or when clearance of 2 inches is exceeded.

### 3.8 SPACER INSTALLATION

- A. There must be no inadvertent metallic contact between casing and carrier pipe. Spacing of spacers should ensure that carrier pipe is adequately supported throughout its length, particularly at ends, to offset settling and possible electrical shorting. Place end spacer within 6 inches of end of casing pipe, regardless of size of casing and carrier pipe or type of spacer used. Spacing between spacers depends largely on load bearing capabilities of pipe coating and flexibility of pipe.
- B. Grade bottom of trench adjacent to each end of casing to provide firm, uniform, and continuous support for carrier pipe. If trench requires some backfill to establish final trench bottom grade, place backfill material in 6-inch lifts and compact to the density of undisturbed soil.
- C. Install casing spacers in accordance with manufacturer's instructions. Take special care to ensure that subcomponents are correctly assembled and evenly tightened, and that no damage occurs during tightening of insulators or carrier pipe insertion.
- D. Seal annulus between carrier pipe and casing with casing end seals at each end of casing.
- E. Insulator Spacing:
  - 1. Spacing shall be as shown on Drawing with maximum distance between spacers to be 10 feet for pipe sizes 4 to 14 inches and 8 feet for pipe sizes 16 to 30 inches.
  - 2. For ductile iron pipe, flanged pipe, or bell-and-spigot pipe, spacers shall be installed within one foot on each side of bell or flange and one in center of joint when 18- to 20-foot-long joints are used.
  - 3. If casing or carrier pipe is angled, bent, or dented, reduce spacing as directed by Engineer.

### 3.9 SETTLEMENT SURVEYING

- A. Record the ground surface elevation ahead of the augering operation. Record the elevation of each survey point with an accuracy of 0.01 feet. Locate survey points as follows:
  - 1. Railroads. Track subbase at centerline of each track.
  - 2. Pipeline crossings. Directly above and 10 feet before and after the crossing.
- B. Report settlement observations daily to Engineer and continue until any noticeable settlement has stopped. In the case of observed settlement, increase the monitoring points and observation frequency, as requested by Engineer.

### 3.10 CLEANUP

- A. Conform to applicable provisions of Section 02 41 13.11 – Construction Waste Management and Disposal.

END OF SECTION

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SECTION 33 12 13.10

TAPPING SLEEVES AND VALVES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tapping sleeves and valves for connections to existing water system.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for tapping sleeves and valves will be on a unit price basis for each tapping sleeve and valve installed.
- B. 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 A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
- B. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
- C. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service.
- D. AWWA C 110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.
- E. AWWA C 200 - Standard for Steel Water Pipe - 6 in. and Larger.
- F. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.
- G. AWWA C 500 - Standard for Metal Seated Gate Valves, for Water Supply Service.

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit results of tapping sleeves NPT test opening.
- C. Submit manufacturer's affidavit as required in Division 1.

1.5 DELIVERY, STORAGE AND HANDLING

Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### A. Tapping Sleeves:

1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
2. Branch Outlet of Tapping Sleeve:
  - a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.
  - b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
3. Use cast iron split sleeve where fire service from 6-inch water line is approved.

#### B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.
2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
3. Steel sleeves are restricted to use on pipe sizes 6 inches and larger.
4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.
5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.
6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12 mil thickness.
7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.
8. Provide approved steel tapping sleeves.
9. Tapping Sleeves: Provide with 3/4-inch NPT test opening for testing prior to tapping. Provide 3/4-inch bronze plug for opening.
10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

#### C. Stainless Steel tapping-sleeve bodies and flange may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.
2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.
3. Stainless Steel sleeves are restricted to use on pipe sizes 4 inches and larger.
4. Body: ASTM A240 Stainless Steel, Type 304.
5. Bolts: ASTM A193 Stainless Steel, Type 304.
6. Nuts: ASTM A194 Stainless Steel, Type 304.
7. Branch Outlet: Heavy Stainless Steel Pipe.
8. Provide approved stainless steel tapping sleeves.
9. Do not use stainless steel sleeves for taps greater than 75 percent of pipe diameter.

#### D. Tapping Valves: Meet requirements of Division 33 with following exceptions:

1. Inlet Flanges:
  - a. AWWA C 110; Class 125.
  - b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.
2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.
3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

#### E. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Division 33.

## PART 3 EXECUTION

### 3.1 APPLICATION

- A. Install tapping sleeves and valves at locations and of sizes shown on Drawings. Install sleeve so valve is in horizontally level position unless otherwise indicated on Drawings.
- B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.
- C. Hydrostatically test installed tapping sleeve to 150 psig for minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.
- D. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than water line being tapped.
- E. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

### 3.2 INSTALLATION

- A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.
- B. Tighten bolts in proper sequence so that undue stress is not placed on pipe.
- C. Align tapping valve properly and attach to tapping sleeve. Insert insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.
- D. Make tap with sharp, shell cutter:
  - 1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.
  - 2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.
- E. Withdraw coupon and flush cuttings from newly-made tap.
- F. Wrap:
  - 1. For 12-inch and smaller tap, wrap completed tapping sleeve and valve in accordance with Division 2.
  - 2. For 16-inch and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of 16 mils.
- G. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).
- H. Request inspection of installation prior to backfilling.
- I. Backfill in accordance with Division 31.

END OF SECTION

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SECTION 33 12 13.12

WET CONNECTIONS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

- A. Wet connections for new water mains and service lines to existing water mains.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for wet connections are on a unit price basis for each wet connection made.
- B. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

- A. AWWA C 800 - Underground Service Line Valves and Fittings.

1.4 DEFINITIONS

- A. Wet connections consist of isolating sections of pipe to be connected with installed valves, draining the isolated sections, and completing the connections.
- B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of a 2-inch service line.

PART 2 P R O D U C T S

2.1 MATERIALS

- A. Pipe shall conform to requirements of applicable portions of Division 33 related to piping materials and to water distribution.
- B. Corporation cocks and saddles shall conform to requirements in Division 33.
- C. Valves shall conform to requirements of Section 33 12 16 – Water Utility Distribution Valves.
- D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 E X E C U T I O N

3.1 CONNECTION OPERATIONS

- A. Plan wet connections in such manner and at such hours as to least inconvenience public. Notify Engineer at least 48 hours in advance of making connections.
- B. Do not operate valves on mains in use by Owner. Owner Representative will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.
- C. Conduct connection operations when Owner Representative is at job site. Connection work shall progress without interruption until complete once existing mains have been cut or plugs has been removed for making connections.



3.2 2-INCH WET CONNECTIONS

- A. Tap water main. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing main. Use 2-inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

END OF SECTION

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gate valves.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for water utility distribution valves is on a unit price basis for each valve installed.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

- A. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.
- C. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
- D. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.
- E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.
- F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.
- G. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.
- H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit manufacturer's product data for proposed valves for approval.
- C. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.5 QUALITY CONTROL

- A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.

- B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed.
- C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends.
- D. Coatings for Gate Valves 2 inches and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.
- E. Gate Valves 2 inches in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.
- F. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide approved double disc valves. Comply with following requirements unless otherwise specified in Drawings:
  - 1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
  - 2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
  - 3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
  - 4. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
  - 5. O-rings: For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.
  - 6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.
- G. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.
- H. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.
- I. Bolts: AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.
- J. Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:
  - 1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.
  - 2. O rings: For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.
  - 3. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
  - 4. Stem Nut: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.
  - 5. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

6. Bolts: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.
  7. Discs: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.
  8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.
  9. Provide bypass for valves 24 inches and larger.
  10. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.
  11. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.
  12. Stuffing Boxes: Located on top of bonnet and outside gear case.
- K. Gate valves 14 inches to 24 inches: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.
1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.
  2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.
  3. Ensure wedge is symmetrical and seals equally well with flow in either direction.
  4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.
  5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.
  6. Provide high strength bronze stem and nut.
  7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.
  8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.
  9. Provide thrust washers to the thrust collar for easy valve operation.
- L. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.
- M. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.
- N. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.
- O. Provide flanged joints when valve is connected to steel or PCCP.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Earthwork. Conform to applicable provisions of Division 31.
- B. Operation. Do not use valves for throttling without prior approval of manufacturer.

### 3.2 SETTING VALVES AND VALVE BOXES

- A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.
- B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to

undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.

- C. For pipe section of each riser, use only 6 inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve.
- D. Assemble and brace box in vertical position as indicated on Drawings.

### 3.3 DISINFECTION AND TESTING

- A. Assist Owner's Representative with disinfection of valves and appurtenances as required by Division 33 and test as required by Division 33.
- B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.
- C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.
- D. Repair or replace valves which exceed leakage rate.

### 3.4 PAINTING OF VALVES

- A. Paint valves in vaults, stations, and above ground with approved paint.

END OF SECTION

SECTION 33 12 40

VALVE BOXES, METER BOXES, AND METER VAULTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Valve boxes for water service.
- B. Meter boxes for water service.
- C. Meter vaults for water service.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No separate payment will be made for valve boxes under this Section. Include payment in unit price for Section 02570 - Water Mains.
  - 2. No separate payment will be made for meter boxes under this Section. Include payment in unit price for Section 02512 - Water Tap and Service Line Installation.
  - 3. Payment for meter vaults is on a unit price basis per vault. Payment will be made for each vault installed regardless of depth.
- B. 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 48 - Standard Specification for Gray Iron Castings.
- B. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
- E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- F. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.

1.4 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Submit manufacturers' product data for following items for approval:
  - 1. Each type of valve box and lid.
  - 2. Each type of meter box and cover.
  - 3. Each type of meter vault frame and cover.
- C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in State of Texas.
- D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

- E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.05, Plastic Meter Boxes.

## PART 2 PRODUCTS

### 2.1 VALVE BOXES

- A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid. In grassy areas, top of valve box to be set 4" above finished grade if more than 20' from existing or proposed sidewalk. Otherwise, top of valve box to be flush with finished grade.
- B. Cast letter "W" into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.
- C. Unless otherwise specified, uncoated cast iron.
- D. Riser Pipe.
  - 1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Division 33 or
  - 2. 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Division 33.
  - 3. Provide single section of pipe.
- E. Concrete for valve box placement:
  - 1. For locations in new concrete pavement, provide strength and mix design of new pavement.
  - 2. For other locations, provide concrete for sidewalks conforming to requirements of Division 32.

### 2.2 METER BOXES

- A. Provide meter boxes as required by the governing authority and as shown on the drawings.

### 2.3 CAST-IRON METER BOXES

- A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.
- B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.
- C. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

### 2.4 CONCRETE METER BOXES

- A. Concrete Meter Boxes: Made of Class A concrete, with minimum 4000 psi compressive strength, conforming to requirements of Division 32. Construct to dimensions shown on Drawings.
- B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

## 2.5 PLASTIC METER BOXES

A. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:

ASTM	REQUIREMENT
D 256	Impact Strength = 1/9 ft.-lb./inch (Izod, Notched)
D 256	Impact Strength – 6.4 ft.-lb./inch (Izod, Un-Notched)
D 638	Tensile Strength (2.0 min.) = 3400 psi
D 648	Deflection Temperature = 170 degrees F
D 2240	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160 inch-lb.
D 790	Flexural Modulus = 90,000 psi

B. Meter boxes shall meet the following test requirements:

1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.
2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8- inch.
3. Meter box body, without lid, shall weigh approximately 7 pounds.

## 2.6 METER VAULTS

- A. Meter vaults may be constructed of precast concrete, cast-in-place concrete, or common brick masonry unless a specific type of construction is required by Drawings.
- B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Division 32 with minimum compressive strength of 4000 psi at 28 days.
- C. Reinforcing steel for meter vaults: Conform to requirements of Division 32.
- D. Grates and Covers: Conform to requirements of Division 33.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Obtain approval from Owner's Representative for location of meter vault.
- B. Verify lines and grade are correct.
- C. Verify compacted subgrade will support loads imposed by vaults.

### 3.2 VALVE BOXES

- A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.
1. Install with bell on top of valve.
  2. Place riser pipe in plumb, vertical position.
- B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.
- C. Set, align, and adjust valve box so that lid is level with final grade.



- D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by Owner, repaint covers black.

### 3.3 METER BOXES

- A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.
- B. Construct concrete meter boxes to dimensions shown on Drawings.
- C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.
- D. Do not locate under paved areas unless approved by Owner's Representative. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

### 3.4 METER VAULTS

- A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.
- B. Precast Meter Vaults:
  - 1. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to requirements of Division 31.
  - 2. Seal lifting holes with cement-sand mortar or non-shrink grout.
- C. Meter Vault Floor Slab:
  - 1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.
  - 2. Precast floor slab elements may be used for precast vault construction.
- D. Cast-in-Place Meter Vault Walls:
  - 1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.
  - 2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
  - 3. Set frame for cover in concrete.

### 3.5 FRAME AND COVER FOR METER VAULTS

- A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
  - 1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above natural grade.
  - 2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2-inch.

### 3.6 BACKFILL

- A. Provide bank run sand in accordance with Division 31 and backfill and compact in accordance with Division 31.
- B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope from top to natural grade.
- C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION

SECTION 33 12 50

FIRE HYDRANTS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire hydrant construction, valves and fittings.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices

1. No separate payment will be made for PVC pipe under this section. Include cost in unit price for related work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fire Hydrants:

1. Certified fire hydrants shall conform to the requirements and tests for American Water Works Association (AWWA) Standard C502-80, or latest revision thereof, entitled, AAWWA Standard for Dry-Barrel Fire Hydrants@ as to their design, component materials, construction, manufacture and testing except as modified or supplemented hereinafter.
2. Fire hydrants shall be 5-1/4 inch Mueller Super Centurion 200 with mechanical joint end inlet, or approved equal, as shown on the Drawings.
3. Threads on nozzles and operating nut shall be National (American) Standard Fire Hose Coupling Screw Threads (per NFPA No. 194 and ANSI B26-1925, latest revision).
4. Hydrants shall conform to the standards of the Texas Fire Insurance Commission.

- B. Valves, Fittings, etc.:

1. Valves, fittings, etc., to be used in the completed installation shall be as specified in Section 33 12 16 - Water Utility Distribution Valves.

- C. Nozzles:

1. Each hydrant shall be equipped with two (2) two and one-half inch (2 1/2") normal inside diameter hose nozzles and one (1) four inch (4") nominal inside diameter pumper nozzle conforming the National (American) Standard Fire Hose Coupling Screw Threads (per NFPA No. 194 and ANSI B26-1925, latest revision).
2. Nozzles shall be securely fastened into the upper barrel by mechanical means, installed by turning counterclockwise, and shall be locked in place with a security device.
3. Nozzle caps shall be furnished complete with rubber or neoprene gaskets and shall be securely attached to the hydrant barrel with chains of not less than one-eighth inch (1/8") diameter.
4. The pumper nozzle shall be so situated as to allow an unobstructed radius of ten (10) inches from the threaded surface of the nozzle thought the path of travel of a wrench or other device used to fasten a hose to the nozzle.

- D. Each hydrant shall be equipped with an effective breakable hydrant barrel feature.

- E. Operating and Hold Down Nuts:

1. The operating and hold down nuts shall be fabricated of stainless steel or of cast or ductile iron with bronze inserts or, in the alternative, a security device will be provided with each hydrant employing a bronze operating nut to protect this feature of each hydrant from malicious mischief

- or unauthorized removal. Any such security devices shall not require special tools for normal off/on operation of the hydrant.
2. Hold down assemblies shall be fabricated of suitable metallic materials for the service intended.
- F. The inlet shall be a bell end connection designed for connection to a nominal six-inch (6") hub end, push-on, or mechanical joint assembly as specified in the bidding documents.
- G. Shut-off valve shall be of the Acompression type@ design, closing with the pressure, with center stem construction. The shut-off valve opening shall be circular and shall have a diameter of not less than five and one-quarter inches (5-1/4").
- H. The hydrant shall operate to open by turning to the left (counterclockwise).
- I. Valve Mechanism:
1. The valve seat ring shall be constructed of bronze and shall be threaded into a bronze drain ring to provide an all bronzed drainway.
  2. The seat ring and main valve assembly shall be such that it can be removed from above ground through the upper barrel by means of a light-weight seat removal wrench.
  3. The valve seat facing shall be constructed of molded rubber having a Durometer rating of 90 ± 5, and shall a minimum thickness of one-half inch (2").
  4. The valve stem shall be provided with a breakable stem coupling opposite the barrel breakaway feature. Connecting pins and locking devices shall be constructed of bronze or other corrosion-resistant material. The valve stem shall be provided with a bronze sleeve, suitable AO-ring@ seals, and a travel stop.
  5. Operating threads and bearing surfaces shall be fully lubricated when opening or closing the main valve and shall be contained in a lubricating reservoir which is sealed at top and bottom.
  6. The operating assembly shall be provided with a thrust bearing or lubricated thrust collar to minimize operating torque.
- J. Hydrant Barrel:
1. The lower hydrant barrel shall be fabricated as a single piece, and shall be connected to the upper hydrant barrel by means of a joint coupling that will provide three hundred and sixty degree (360°) rotation of the upper barrel.
  2. The bury length shall be as specified and shall be the distance from the bottom of the inlet to the grounded line. The ground line shall be clearly marked on the barrel.
- K. A bronze or corrosion-resistant material lined drain opening shall be provided. Tapping of drain holes is not required. There shall be no springs, toggle joints, or intricate synchronizing mechanisms in proximity to the drain opening(s).
- L. All dynamic seals shall be of AO-ring@ type not requiring adjustment for a watertight seal; shall be of oil-resistant material; and all moving parts in contact with the seal shall be bronze or other corrosion-resistant material. Static seals shall be rubber, asbestos or other approved composition.
- M. The hydrant barrel shall be designed to permit the use of one or more standard extensions, which shall be available from the hydrant manufacturer, in lengths from 6 inches to 60 inches in 6-inch increments.

## 2.2 PAINTING AND COATING

A. Hydrants shall be shop coated with a suitable primer and finish painted in the following manner:

1. The hydrant barrel shall be painted blue using Texstar enamel or approved equal. The hydrant bonnet shall be painted reflective white with glass beads. The cap shall be painted using Texstar enamel or approved equal as follows:

Line Size	Color of Bonnet and Caps
6-inch	Safety Yellow
8-inch	Brilliant White
10-inch and larger	Safety Green

2. Surfaces below the bury line shall be coated with coal-tar enamel or asphalt-base bituminous coating material not less than one (1) mil thickness.
3. Interior surfaces below the main valve shall be coated with epoxy in conformance with AWWA C-550 (latest revision).

## 2.3 TESTING

A. Certified fire hydrants shall comply with the performance standards as stated below. Compliance shall be determined through actual testing of each type or style of fire hydrant proposed for certification.

1. Hydraulic Performance Standards:

- a. Provide a discharge of 1,500 gpm or greater from the single pumper nozzle at a maximum permissible head loss of 8 psig for an inlet operating pressure of no more than 35 psig  $\pm$  2 psig.
- b. A certified pressure loss and quantity of flow test shall be conducted by a qualified testing laboratory on production model (five-foot bury length) of the hydrant (same catalog number) proposed for certification. This testing shall be conducted in strict accordance with AWWA standard C-502 (latest revision). A certified test report shall be submitted, and shall contain the following information:
  - 1) The date of test on a fire hydrant with similar hydraulic characteristics.
  - 2) The name, catalog number, place of manufacture, and date of production of the hydrant(s) tested.

B. Traffic Impact Performance Standards:

1. Certified fire hydrants shall be equipped with a breakable barrel feature and breakable valve stem coupling such that vehicular impact will result in a clean break of the barrel and the valve stem at the breakable feature.
2. Upon impact, the hydrant shut-off valve will remain closed and tight against leakage.
3. Damage to the hydrant and appurtenances resulting in an estimated cost in excess of the one hundred dollars (\$100) for replacement breakable barrel feature parts or failure of the barrel to cleanly and completely break upon impact shall be cause for rejection of the hydrant.

C. Traffic Impact Testing:

1. A certified test report shall be provided which outlines the results of a traffic impact test involving standard production models of the fire hydrant with a breakable barrel the same in design to that proposed for certification.
2. These hydrants shall be installed in strict accordance with the requirements of AWWA Standards C-600 (latest revision), and shall be struck at a point 18 inches  $\pm$  2 inches above the designated ground line.

3. The proximate point of impact or the hydrant barrel shall be within two inches of the line perpendicular to the base and equidistant from the pumper nozzle and one hose nozzle.
4. The intent of the traffic impact test will be to fulfill the following impact scenario through a mechanical impact test procedure approved in writing by the Engineer:
  - a. The point of impact on the vehicle front bumper shall be within six inches of a point equidistant for the midpoint of the bumper and the end point.
  - b. Impact velocity shall be 30 mph  $\pm$  5 mph.
  - c. Successive tests shall be conducted to simulate an impact by standard American-made vehicles with net vehicle weights of 3000, 5000, and 10,000 pounds  $\pm$  500 pounds.

### PART 3 EXECUTION

#### 3.1 CONSTRUCTION METHODS

- A. Allowable methods are specified as follows:
  1. The setting of fire hydrants shall be performed in conformity with applicable portions of Section 33 11 00 - Water Utility Distribution Piping..
- B. Hydrants shall be placed at the locations shown on the Drawings and in conformity with details thereon, unless otherwise directed by the Owner=s Representative.
- C. Hydrants, valves, and valve boxes shall be set plumb with valve boxes placed directly over the valves after they have been completed.

END OF SECTION

SECTION 33 13 00

DISINFECTING OF WATER UTILITY DISTRIBUTION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Disinfection of potable water utility distribution piping.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No separate payment will be made for disinfection of water utility distribution under this Section. Include cost in unit price of water utility distribution piping being disinfected.
- B. 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. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 PRODUCTS -Not Used

PART 3 EXECUTION

3.1 CONDUCTING DISINFECTION

- A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to Public water distribution system.
- B. Contractor shall provide water for disinfection at no additional charge to the Owner.
- C. Unless otherwise provided in Contract Documents, Contractor will conduct disinfection operations.
- D. Coordinate chlorination operations through Owner's Representative.

3.2 PREPARATION

- A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to Public water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.
- B. Use fire hydrants as blow-offs to flush newly constructed water lines 8 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.
- C. Slowly fill each section of pipe with water in manner approved by Owner's Representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.
- D. Backfill excavations immediately after installation of risers or blow-offs.
- E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

### 3.3 DISINFECTION BY CONTRACTOR

- A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:
1. Use not less than 100 parts of chlorine per million parts of water.
  2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
  3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.
  4. Open and close valves in lines being sterilized several times during contact period.
  5. If chemical compound is used for sterilizing agent, place in pipes as directed by Owner's Representative.

### 3.4 BACTERIOLOGICAL TESTING

- A. After disinfection and flushing of water lines, bacteriological tests will be performed by the governing agency or testing laboratory in accordance with Division 1. When test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, assist Contractor shall provide additional disinfection operations at no additional cost to the Owner.

### 3.5 COMPLETION

- A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 33 13 00.10

HYDROSTATIC TESTING OF PIPELINES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Field hydrostatic testing of newly installed water pipelines.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION

3.1 PREPARATION

- A. Disinfect water system pipelines prior to hydrostatic testing.
- B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to Public water distribution system.
- C. Water for testing will be charged to Contractor in accordance with applicable Ordinances. Prior to hydrostatic testing, obtain a transient meter from the appropriate governing authority. Contractor shall pay all fees associated with transient meter.
- D. Test pipelines in lengths between valves, or plugs, of not more than 4,000 feet.
- E. Conduct hydrostatic tests in presence of Owner's Representative.

3.2 TEST PROCEDURES

- A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.
- B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.
- C. For small diameter pipelines, expel air and apply minimum test pressure of 125 psi. For large diameter water lines, expel air and apply minimum test pressure of 150 psi.
- D. Begin test by 9:00 a.m. unless otherwise approved by Owner's Representative. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.
- E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.3 ALLOWABLE LEAKAGE FOR WATERLINES

- A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.



- B. Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.
- C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Owner's Representative for leakage during pressure test may be used to fulfill requirements of this section.

#### 3.4 CORRECTION FOR FAILED TESTS

- A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.
- B. Owner's Representative may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Division 33. Pay for water required for additional disinfection and retesting.
- C. Repeat test until satisfactory results are obtained.

#### 3.5 COMPLETION

- A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 33 31 00

SANITARY UTILITY SEWERAGE PIPING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. Payment for pipe installation is on a linear foot basis. Measurement will be taken along the center line of the pipe from center line to center line of manholes. Payment will be made for each linear foot installed complete in place including sewer pipe, excavation, bedding, backfill and special backfill, shoring, earthwork, connections to existing manholes and pipe, stacks, cleanouts, accessories, and post TV inspection.
- B. 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 proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.
- C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video tapes become property of Owner.

1.4 QUALITY ASSURANCE

- A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Division 33.
- B. Regulatory Requirements.
  - 1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.
  - 2. Make notification to Owner's Representative when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
  - 3. Lay gravity sewer lines in straight alignment and grade.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Inspect pipe and fittings upon arrival of materials at job site.
- B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.
- C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

## PART 2 PRODUCTS

### 2.1 PIPE

- A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified. No SDR allowed on 4" and smaller pipe.
- B. Reinforced concrete pipe is not acceptable.

### 2.2 PIPE MATERIAL SCHEDULE

- A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in Division 33.
- B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.
- C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

### 2.3 APPURTENANCES

- A. Stacks. Conform to requirements of Division 33.
- B. Service Connections. Conform to requirements of Division 33.
- C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

### 2.4 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

- A. Bedding and Backfill: Conform to requirements of Division 31.
- B. Topsoil: Conform to requirements of Division 32.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Division 1.
- B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.
- C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Division 31 for excavations over 5 feet deep.
- D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Owner's Representative and agency or utility company for repairs or relocations, either temporary or permanent.
- E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Division 2.
- F. Install and operate dewatering and surface water control measures in accordance with Division 1.
- G. Do not allow sand, debris or runoff to enter sewer system.

### 3.2 DIVERSION PUMPING

- A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Owner's Representative.
- B. Design piping, joints, and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.
- C. No sewage shall be diverted into area outside of sanitary sewer.
- D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Owner's Representative so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Owner's Representative.

### 3.3 EXCAVATION

- A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.
- B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Owner's Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.
- C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Division 31.

### 3.4 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Owner's Representative.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.
- E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.
- G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Owner's Representative.
- H. Keep excavations free of water during construction and until final inspection.
- I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full 18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

- K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 6-inch separation distance.
- L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

### 3.5 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.

### 3.6 INSTALLATION OF APPURTENANCES

- A. Service Connections. Install service connections to conform to requirements of Division 33.
- B. Stacks. Construct stacks to conform to requirements of Division 33.
- C. Construct manholes to conform to requirements of Division 33 as applicable. Install frames, rings, and covers to conform to requirements of Division 33.

### 3.7 INSPECTION AND TESTING

- A. Visual Inspection: Check pipe alignment in accordance with Division 33.
- B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Division 33.
- C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Division 33. Maintain piezometer installed to conform with Division 1 until acceptance testing is completed.

### 3.8 BACKFILL AND SITE CLEANUP

- A. Backfill and compact soil in accordance with Division 31.
- B. Backfill trench in specified lifts only after pipe installation is approved by Owner's Representative.
- C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Division 32.
- D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and apply hydromulch according to requirements of Division 32.
- E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and sod disturbed areas in accordance with Division 32.

### 3.9 POST-INSTALLATION TELEVISION INSPECTION

- A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.
- B. Select and use closed-circuit television equipment that will produce color video tape. Produce video tape using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera

lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.

- C. Perform television inspection of gravity sanitary sewers as follows:
1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.
  2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.
  3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.
- D. Provide video tapes on CD in a format compatible with Windows Media Player. Two labels are required. Place one label on the case and the other on face of each CD. Permanently label each video tape with following information.

Face of CD

Wastewater File No.: _____	Contractor's Name: _____
Inspection Type: <input type="checkbox"/> Survey <input type="checkbox"/> Pre-Installation <input type="checkbox"/> Post-Installation	
Tape No.: _____	Date Televised: _____
Basin No.: _____	Date Submitted: _____

CD Case

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- E. For each video tape provide completed TV Inspection Report, as attached at end of this section. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.
- F. Upon completion of video tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

# TELEVISION INSPECTION CODES

## HEADER INFORMATION

LOCATION	
A	STREET ROW, HEAVY TRAFFIC
B	STREET ROW, LIGHT TRAFFIC
C	EASEMENT, POOR ACCESS
D	EASEMENT, GOOD ACCESS
E	PARKING LOT, POOR ACCESS
F	PARKING LOT, GOOD ACCESS
G	ALLEY, POOR ACCESS
H	ALLEY, GOOD ACCESS
I	OPEN AREA, POOR ACCESS
J	OPEN AREA, GOOD ACCESS

## SURFACE COVER

A	ASPHALT STREET
B	CONCRETE STREET
C	SHELL STREET
D	SIDEWALK
E	TREES/SHRUBS
F	CLOSE TO FENCE
G	OPEN AREA
H	MOVABLE BUILDING
I	UNMOVABLE BUILDING
J	OVERHEAD UTILITIES
K	WATERWAY OR RAILWAY
L	HIGHWAY OR RUNWAY
M	PIPE ABOVE GROUND

## PIPE TYPE

ABS	ACRYLONITRILE BUTADIENE STYRENE
BRK	BRICK
CIP	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CON	POURED IN PLACE CONCRETE
CPP	CURED IN PLACE PIPE
DIP	DUCTILE IRON PIPE
FRP	FIBERGLASS REINFORCED PIPE
PLP	PLASTIC LINE CONCRETE PIPE
PEP	POLYETHYLENE PIPE
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
RPM	REINFORCED PLASTIC MORTAR PIPE
RCP	REINFORCED CONCRETE PIPE
URC	UNREINFORCED CONCRETE PIPE
VCP	VITRIFIED CLAY PIPE

## JOINTS

MJ – MISALIGNED JOINT    BJ-BROKEN JOINT		
CODES	DESCRIPTION	USE IN
A (3)	RP JT > 90% CLEAR	MJ
B (6)	DRP JT 80 – 90% CLEAR	MJ
C (9)	DRP JT < 80% CLEAR	MJ
D (3)	SHF JT > 90% CLEAR	MJ
E (6)	SHF JT 80 – 90% CLEAR	MJ
F (9)	SHF JT < 80% CLEAR	MJ
G (1)	WD JT 2" – 3"	MJ
H (2)	WD JT 3" – 4"	MJ
I (3)	WD JT > 4"	MJ
J (2)	BRK JT – LIGHT	BJ
K (4)	BRK JT – MEDIUM	BJ
L (6)	BRK JT – HEAVY	BJ
N (0)	VISIBLE GASKET	MJ
O (0)	LEAKING AT JOINT	MJ

## LATERALS (L)

CODES	DESCRIPTION
A (1)	PRT SER 0" – 1"
B (2)	PRT SER 1" – 2"
C (3)	PRY SER 2" – 3"
D (4)	PRT SER 3" +
E (5)	EFFECT E – SERVICE CONN.
F (6)	DEAD/UNUSED SERVICE
G (7)	FACTORY SERVICE
H (0)	PLUMBER SERVICE

## ROOTS (R)

CODES	DESCRIPTION
A (1)	ROOTS - LIGHT
B (2)	ROOTS - MEDIUM
C (3)	ROOTS – HEAVY

## DEBRIS (D)

CODES	DESCRIPTION
A	DEBRIS - LIGHT
B	DEBRIS - MEDIUM
C	DEBRIS - HEAVY
D	GREASE - LIGHT
E	GREASE - MEDIUM
F	GREASE – HEAVY

## INFLOW/INFILTRATION (I)

CODES	DESCRIPTION
A (3)	I/I – LIGHT (0-1 GPM)
B (6)	I/I – MEDIUM (1-5 GPM)
C (9)	I/I – HEAVY ( > 5 GPM)
D (2)	I/I – SOME EVIDENCE
E (4)	I/I – CONSIDERABLE EVIDENCE
F (6)	I/I – GREAT EVIDENCE
G (0)	I/I – NO EVIDENCE

WEATHER	
DRY - WET	
CODE DESCRIPTIONS	
<b>CRACKS</b>	
RC-RADIAL	LC-LONGITUDINAL

CODES	DESCRIPTION	USE IN
A (1)	< ½" W, 1' L	CRK
B (2)	< ½" W, 1' - 2' L	CRK
C (3)	< ½" W, >2' L	CRK
D (4)	> ½" W, < 1' L	CRK
E (5)	> ½" W, 1' - 2' L	CRK
F (6)	> ½" W, > 2' L	CRK
G (7)	HOLE IN PIPE - SMALL	
H (8)	PIPE MISSING - < 60°	
I (9)	PIPE MISSING - > 60°	

ALIGNMENT (A)	
CODES	DESCRIPTION
A	BEGIN ¼ PIPE WATER
B	BEGIN ½ PIPE WATER
C	CAMERA UNDERWATER
D	END CAMERA UNDERWATER
E	END ½ PIPE WATER
F	END ¼ PIPE WATER

STRUCTURAL		
DS-DETERIORATED; OS-OVALITY; CS COLLAPSED		
CODES	DESCRIPTION	USE IN
A (3)	LINE DET - LIGHT	DS
B (6)	LINE DET - MEDIUM	DS
C (9)	LINE DET - HEAVY	DS
D (3)	OVAL < 5%	OS
E (6)	OVAL > 5% & < 10%	OS
F (9)	OVAL > 10%	OS
G (9)	COLLAPSED	CS
H (0)	PIPE DET - HEAVY	DS
L (0)	PIPE DET - LIGHT	DS
M (0)	PIPE - MEDIUM	DS
N (0)	PIPE DET - NONE	DS
O	LINE DET - NONE	DS
Z (0)	AT MANHOLE NUMBER	CS

END OF SECTION



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SECTION 33 31 00.10

ACCEPTANCE TESTING FOR SANITARY SEWERS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Acceptance testing of sanitary sewers including:
  - 1. Visual inspection of sewer pipes.
  - 2. Mandrel testing for flexible sewer pipes.
  - 3. Leakage testing of sewer pipes.
  - 4. Leakage testing of manholes.
  - 5. Smoke testing of point repairs.
  - 6. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No payment will be made for acceptance testing under this Section. Include payment in unit price for work requiring acceptance testing.
- B. 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 828 - Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.
- B. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
- C. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- D. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- E. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.
- B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.
- C. Maximum allowable leakage for Infiltration or Exfiltration.
  - 1. The total exfiltration, as determined by hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at minimum test head of 2 feet above crown of pipe at upstream manhole or 2 feet above groundwater elevation, whichever is greater.
  - 2. When pipes are installed more than 2 feet below groundwater level, use infiltration test in lieu of exfiltration test. Total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe

per 24 hours. Groundwater elevation must be at least 2 feet above crown of pipe at upstream manhole.

3. Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.
- D. Perform air testing in accordance with requirements of this Section and Texas Natural Resources Conservation Commission requirements. Refer to Table 33 31 00.10-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test, and Table 33 31 00.10-4, Vacuum Test Time Table, at end of this Section.

#### 1.5 SUBMITTALS

- A. Conform to requirements of Division 1.
- B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Owner's Representative. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.
- C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

#### 1.6 GRAVITY SANITARY SEWER QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and video tape of television inspection as directed by Owner's Representative.
- C. Upon completion of tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

#### 1.7 SEQUENCING AND SCHEDULING

- A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.
- B. Coordinate testing schedules with Owner's Representative. Perform testing under observation of Owner's Representative.

### PART 2 PRODUCTS

#### 2.1 DEFLECTION MANDREL

- A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.
- C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.
- D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 30 31 00.10-5, Pipe vs. Mandrel Diameter, at end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Owner's Representative.

## 2.2 EXFILTRATION TEST

- A. Water Meter: Obtain transient water meter from appropriate governmental agency for use when water for testing will be taken from public system. Conform to governmental agency requirements for water meter use.
- B. Test Equipment:
  - 1. Pipe plugs.
  - 2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

## 2.3 INFILTRATION TEST

- A. Test Equipment:
  - 1. Calibrated 90 degree V-notch weir.
  - 2. Pipe plugs.

## 2.4 LOW PRESSURE AIR TEST

- A. Minimum Requirement for Equipment:
  - 1. Control panel.
  - 2. Low-pressure air supply connected to control panel.
  - 3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
  - 4. Air hoses from control panel to:
    - a. Air supply.
    - b. Pneumatic plugs.
    - c. Sealed line for pressuring.
    - d. Sealed line for monitoring internal pressure.
- B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

## 2.5 GROUND WATER DETERMINATION

- A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

## 2.6 SMOKE TESTING

- A. Equipment:
  - 1. Pneumatic plugs.
  - 2. Smoke generator as supplied by Superior Signal Company, or approved equal.
  - 3. Blowers producing 2500 scfm minimum.

# PART 3 EXECUTION

## 3.1 PREPARATION

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Division 1.

## 3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

- A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

### 3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
- B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
- C. Retest repaired or replaced sewer sections.

### 3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

- A. Test Options:
  - 1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
  - 2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo physical inspection prior to testing.
  - 3. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
  - 4. If no installed piezometer is within 500 feet of sewer segment, provide temporary piezometer for this purpose.
- B. Compensating for Ground Water Pressure:
  - 1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
  - 2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.
- C. Exfiltration test:
  - 1. Determine ground water elevation.
  - 2. Plug sewer in downstream manhole.
  - 3. Plug incoming pipes in upstream manhole.
  - 4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
  - 5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
  - 6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 33 31 00.10-1 at end of this Section.
- D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).
  - 1. Determine ground water elevation.
  - 2. Plug incoming pipes in upstream manhole.
  - 3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
  - 4. Allow water to rise and flow over weir until it stabilizes.
  - 5. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 33 31 00.10-1 at end of this Section.
- E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 33 01 30-2.

1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
3. For pipe sections less than 36-inch average inside diameter:
  - a. Determine ground water level.
  - b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.
  - c. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
  - d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 33 31 00.10-2 at end of this Section.
  - e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 33 31 00.10-2 at end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

### 3.5 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of this Section.

B. Low Pressure Air Test:

1. Times in Table 33 31 00.10-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Natural Resources and Conservation Commission (TNRCC) Design Criteria 317.2(a)(4)(B).

		$T = 0.0850(D)(K)/(Q)$
Where:	T =	Time for pressure to drop 1.0 pounds per square inch gauge in seconds
	K =	0.000419 DL, but not less than 1.0
	D =	Average inside diameter in inches
	L =	Length of line of same pipe size in feet
	Q =	Rate of loss, 0.0015 ft <sup>3</sup> /min./sq. ft. internal surface

2. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test.

#### Notes:

1. When two sizes of pipe are involved, compute time by ratio of lengths involved.
2. Lines with 27-inch average inside diameter and larger may be air tested at each joint.
3. Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4. If joint test is used, perform visual inspection of joint immediately after testing.
5. For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

### 3.6 LEAKAGE TESTING FOR MANHOLES

- A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
- B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 33 31 00.10-4, Vacuum Test Time Table.
3. If drop in vacuum exceeds 1 inch Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Perform hydrostatic exfiltration testing as follows:

1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

### 3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.
2. Determine when point repairs are properly made.
3. Determine when service connections have been reconnected to rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for sliplined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer's recommendation and as approved by Owner's Representative.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation as approved by Owner's Representative.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

Table 33 31 00.10-1

WATER TEST ALLOWABLE LEAKAGE

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100 FEET
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

\* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain.

Table 33 31 00.10-2  
ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Diam. (in.)	Min. Time	Length For Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:2	11:2	11:2	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	0	0	0	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	14:1	14:1	17:4	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.470	0	0	8	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:4
24	22:40	99	8	17:0	19:1	25:3	56:59	68:23	79:47	91:10	102:3	113:5	125:2	2
27	25:30	88	13.676	0	4	9	72:07	86:33	100:5	115:2	4	8	2	136:4
30	28:20	80	2	19:5	26:1	35:5	89:02	106:5	8	4	129:4	144:1	158:4	6
33	31:10	72	17.308	0	1	4	107:4	1	124:3	142:2	9	4	0	173:0
			9	22:4	34:1	45:3	4	129:1	9	8	160:1	178:0	195:5	5
			21.369	8	1	5		7	150:5	172:2	6	5	3	213:4
			0	28:5	43:1	57:4			0	3	193:5	215:2	237:0	1
			25.856	1	6	2					5	8	1	258:3
			5	35:3	53:2	71:1								4
				7	5	4								
				43:0	64.3	86:1								
				6	8	1								



Table 33 31 00.10-3  
MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

Table 33 31 00.10-4  
VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER		
	48"	60"	72"
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0

\*Add T times for each additional 2-foot depth.  
(The values listed above have been extrapolated from ASTM C 924-85)

Table 33 31 00.10-5

PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches)	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725

	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass (Class SN 46)	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

END OF SECTION

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SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. Payment for storm sewers is on a linear foot basis for each type and size of pipe installed. Measurement will be taken along the center line of the pipe from center line to center line of manholes or from end to end of culverts.
  - 2. No separate payment will be made for earthwork, connections to existing manholes and pipe, accessories, equipment, and execution required or incidental to storm sewer work. Include cost in unit price for sewer pipe.
- B. 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 to avoid contact with ground.
- D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.
- E. Keep interiors of pipe and fittings free of dirt and foreign matter.
- F. Store PVC pipe out of direct sunlight.

## PART 2 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

SECTION 33 49 13

STORM DRAINAGE MANHOLES, FRAMES AND COVERS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

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. Unit Prices:
  - 1. No payment will be made for frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.
- B. 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

